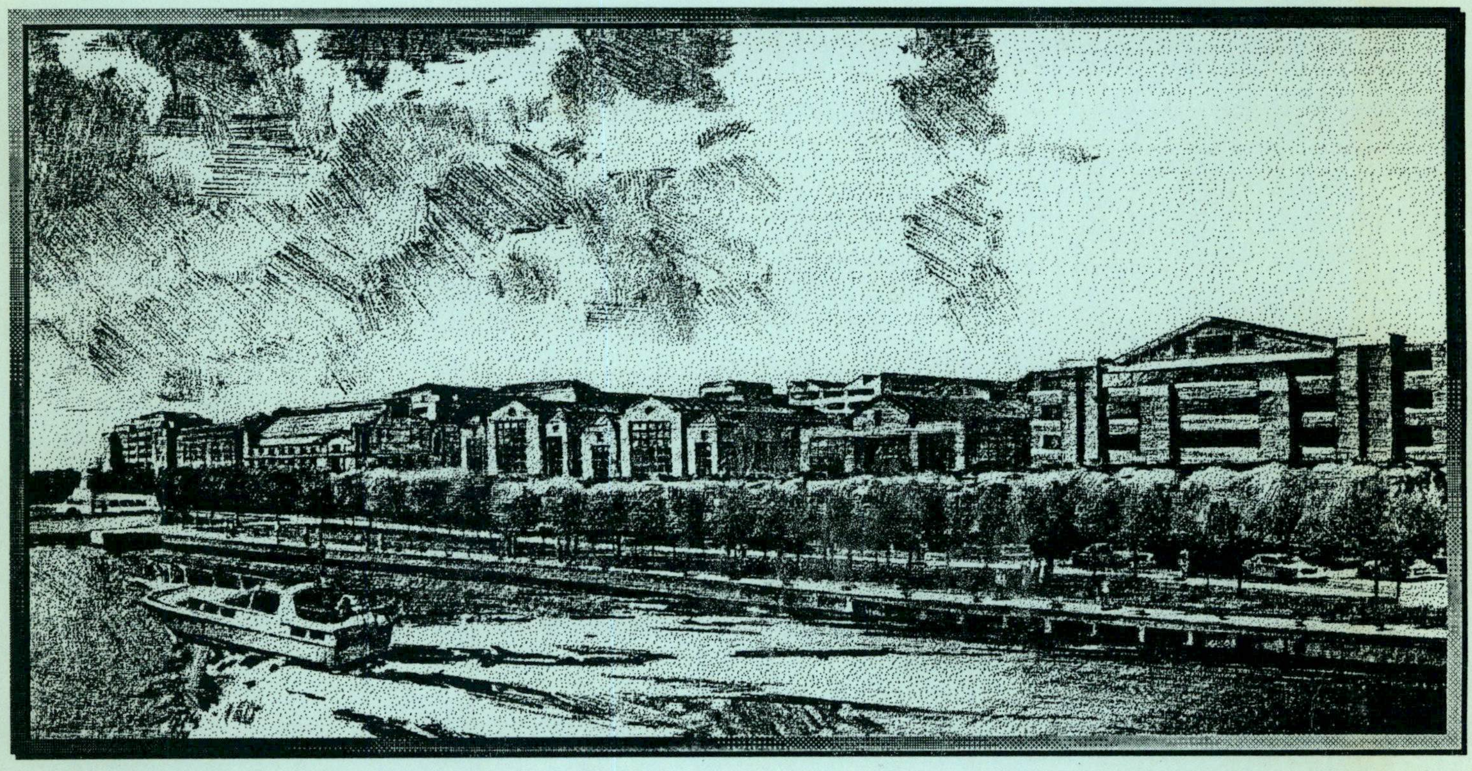
FINAL REPORT
Volume 1 of 2

PHASE II ENVIRONMENTAL SITE ASSESSMENT UPDATE REPORT SOUTHEAST FEDERAL CENTER, WASHINGTON, D.C.

Special Study Number SP1



General Services Administration
Developer

Federal Center Associates
Development Manager

Printed on recycled paper

prepared by

Woodward-Clyde

Woodward-Clyde Federal Services
200 Orchard Ridge Drive, Suite 101
Gaithersburg, Maryland 20878
301 258-9780

APRIL 1996

VOLUME I

LIST OF TABLES

LIST OF FIGURES

PLATES

VOLUME 2 - APPENDICES

This report presents the results of Woodward-Clyde's Phase II ESA Update (Special Study SP-1) for the Southeast Federal Center (SEFC) redevelopment project. The purpose of this report is to summarize data collected during field investigations at SEFC, performed by Woodward-Clyde for this study as well as previous investigations performed on the site by other consultants, and to provide a basis for design of soil and groundwater remediation activities that will be required during the construction of the project. The following items summarize W-C's scope of services for this study:

- Identify "Action Levels" for chemicals-of-concern by (1) reviewing current regulatory standards and disposal requirements, and (2) evaluating current site data to identify potential risks (in accordance with current U.S. Environmental Protection Agency (USEPA) methodologies) associated with future land uses proposed for the SEFC.

- Collect soil and groundwater samples to further define the lateral and vertical extent of contamination in areas previously identified during the Phase I and Phase II investigations.

- Identify other areas of potential concern by collecting soil samples in areas not previously sampled.

- Investigate groundwater quality at the site through the collection and analysis of groundwater samples from Hydropunch™ borings and monitoring wells.

- Provide a volume estimate of contaminated soils requiring special handling or disposal, and groundwater by comparing the data gathered to the "Action Levels".

- Develop a cost estimate for the handling or disposal of contaminated soil and groundwater, based on the analytical results and remedial technologies recommended in the Phase II report.

Contaminants located within the existing structures on the site (including asbestos, lead-based paint, PCB's and animal feces) are the subject of separate Special Studies or previous studies by other consultants and are not addressed in this report.

The Washington Navy Yard was established around 1800 primarily as an area for shipbuilding activities. Expansion of the Navy Yard towards the west occurred between the late 1800's and the early 1940s to include the current SEFC site. A portion of the SEFC site (particularly eastern and southeastern portion) was created by filling the marsh adjacent to the Anacostia River in the early 1900s. Activities at the Navy Yard shifted from shipbuilding to ordnance production near the turn of the 20th century. Naval research and development activities were the primary activities conducted at the site during the World War II era. All ordinance manufacturing and production activities had ceased by 1962, and in 1963 the western portion of the Navy Yard (SEFC) was transferred from the Department of the Navy to the General Services Administration. Since 1963, activities at SEFC have included administrative offices, warehousing and storage space, laboratories and light industrial operations. Contamination of the subsurface soils and to a lessor extent, the shallow groundwater resulted from past industrial activities at the site.

The investigations and evaluation performed by Woodward Clyde for Special Study SP-1 are summarized below:

- Woodward Clyde completed 135 test borings, 41 Hydropunch™ borings and 13 monitoring wells to collect soil and groundwater samples for chemical analyses and to evaluate subsurface conditions at the site. These investigations were generally designed to more accurately delineate the extent of contamination identified in previous studies.

- Using a risk-based approach, "Action Levels" for chemicals-of-concern were developed using current regulatory standards and disposal requirements. These action levels consider that much of the contaminated soil will be excavated and disposed off-site during excavations for building basements and infrastructure development. Both residential and commercial/industrial action levels were developed and all chemical test data was evaluated with respect to these action levels.

- Seventeen chemicals or parameters were detected in site soils at concentrations that exceeded residential action levels: one volatile organic compound (trichloroethene or TCE); six semi-volatile organic compounds (benzo(a)pyrene, bis(2)-chloroisopropyl ether, 3,3'-dichlorobenzidine, nitrobenzene, phenanthrene, and PCBs; nine metals (arsenic, barium, cadmium, copper, iron, lead, mercury, nickel, and selenium); and Total Petroleum Hydrocarbons (TPH).

- A block-by-block evaluation of the chemical test data with respect to the action levels and planned development revealed that the majority of the soils to be excavated are acceptable for use as general fill with no use limitations. Isolated areas of contaminated soil on most of the blocks will require separate excavation, characterization and disposal. Little, if any, of this contaminated soil is expected to require disposal as hazardous waste. Block H appears to have extensive petroleum contamination under most of the block to a depth of about 20 feet (6 meters). Results of the investigation indicate that the petroleum contamination is scattered both laterally and vertically throughout Block H. Review of historical information indicates that this area was formerly a portion of the old Navy Yard, and was used for oil reclamation activities. Additionally, two underground storage tanks (USTs) were once located within the Block. It is likely that the petroleum contamination could be the result of numerous surface spills associated with the oil reclamation activities and the UST's.

- A block-by-block cost estimate for excavation and disposal of the contaminated soil at the site is $12,770,000, including a 15% contingency. The majority of this cost is for the petroleum contamination in Block H, which is not intended for development until a later phase of the SEFC redevelopment.

- Overall, groundwater has been minimally impacted at the Southeast Federal Center. A plume of petroleum hydrocarbon contamination was identified on Block B and portions of Block C and F, that appears to emanate from a former Shell gas station located north of M Street from the site. The costs to remediate this plume should rest with the responsible party, but some impacts on construction are possible. We recommend an allowance of $1,150,000, including a 15% contingency, be used for dealing with groundwater contamination issues during the life of construction for treatment of water generated by construction dewatering efforts.

1.0
INTRODUCTION

1.1 SOUTHEAST FEDERAL CENTER REDEVELOPMENT

The Southeast Federal Center (SEFC) is a Federally owned, 55.3 acre (224,000 square meters) site along the Anacostia River within one mile of the United States Capitol. It is currently an open, waterfront site with a scattering of existing industrial structures, several of which have significant historic and/or aesthetic merit. The U.S. General Services Administration (GSA) has initiated a plan to redevelop this land in a prudent and environmentally responsive way. The redevelopment of the SEFC into a federal office complex for up to 25,000 employees has been planned by GSA since the mid-1960s. Historically, the Southeast Federal Center was formerly part of the Washington Navy Yard that was transferred from the U.S. Navy to the General Services Administration in 1963 (Figure 1-1).

The September 1989 "Master Plan for the Southeast Federal Center" describes the concepts and principal features of the proposed development. The redevelopment of SEFC will involve the demolition or renovation of the existing structures on the site, installation of new infrastructure, replacement of the existing seawall and construction of new buildings with two or three basement levels for parking. Contamination of buildings, soils and groundwater at the site has resulted from past industrial activities, and will require remediation prior to, or in conjunction with, the proposed redevelopment.

AGREE- SUGGEST AN INTEGRATED APPROACH.
I.E. INTEGRATE- THE BUILDING AND RECONSTRUCTION WITH THE CLEANUP

Federal Center Associates (FCA) was awarded a contract by GSA in December 1993 to manage the redevelopment of the initial phases of the SEFC. Woodward-Clyde (W-C) is the team firm responsible for the geotechnical and environmental engineering aspects of the redevelopment of the Southeast Federal Center. In this role, W-C will design the remedial actions for the SEFC and provide oversight during performance of the remedial actions.

ONE - CONCERN - is there any releases that are on going ~~EX~~ EXPOSURE PATHWAYS - WITH RECEPTORS BOTH HUMAN OR ECOLOGICAL

1.2 BACKGROUND FOR THIS SPECIAL STUDY

Apex Environmental (APEX), under contract to DesignTech, Ltd., performed (1) a Phase I Environmental Site Study for the SEFC site in late 1989, and (2) a Preliminary Assessment of the SEFC in early 1990 that included limited sampling and analyses. Kaselaan & D'Angelo (K&D) (1) conducted a Phase II Environmental Site Assessment (ESA) investigation at the SEFC, (2) prepared a Preliminary Screening Health Risk Assessment (PHRA), and (3) presented preliminary cost estimates for remediation of the SEFC in early 1991. K&D reported various soil, groundwater, and building contamination in the "Phase II Report, Subsurface Investigation at the Southeast Federal Center, Washington, DC, July 25, 1991."

This Special Study Number SP-1 (SP-1) was authorized by the General Services Administration (GSA) to follow up on the recommendations made in these previous reports, as well as update and refine cost estimates for remediation of the site in conjunction with its redevelopment. This report updates the Phase II ESA report prepared by K&D (including a cost estimate for remediation and a review of the PHRA included in that report). W-C also conducted a lead-based paint survey of the existing buildings, except Building 213, at the SEFC as part of SP-1. The lead-based paint survey was reported separately to GSA in October 1995.

1.3 OBJECTIVES OF SP-1 INVESTIGATION

THIS MIGHT NOT MATCH OUR GOAL

The primary objective of this Special Study was to develop a practical approach to dealing with contaminated soils and/or groundwater that might be encountered during construction activities at SEFC. In order to accomplish this primary objective, the following secondary objectives were identified:

- Perform supplemental site characterization activities to more fully define the lateral and vertical extent of contamination identified during the Phase I and Phase II investigations, and to fill "data gaps" in areas that were not previously investigated.

- Evaluate the validity and useability of the data and Preliminary Health Risk Assessment generated during the Phase II investigation.

1.4 SCOPE OF THE PHASE II ESA UPDATE REPORT

This document presents Woodward-Clyde's Phase II ESA Update Report for the Southeast Federal Center redevelopment project. The purpose of this report is to summarize data collected during field investigations at SEFC, and to provide a basis for design of remediation activities that will be required during the construction of the project. The following items summarize W-C's scope of services during this investigation:

- Identify "Action Levels" for chemicals-of-concern by (1) reviewing current regulatory standards and disposal requirements, and (2) evaluating current site data to identify potential risks (in accordance with current U.S. Environmental Protection Agency (USEPA) methodologies) associated with future land uses proposed for the SEFC.

- Collect soil and groundwater samples to further define the lateral and vertical extent of contamination in areas identified during the Phase I and Phase II investigations.

- Identify other areas of potential concern by collecting soil samples in areas not previously sampled.

- Investigate groundwater quality at the site through the collection and analysis of groundwater samples from Hydropunch™ borings and monitoring wells.

- Provide a volume estimate of contaminated soils requiring special handling or disposal, and groundwater by comparing the data gathered to the "Action Levels".

- Develop a cost estimate for the handling or disposal of contaminated soil and groundwater, based on the analytical results and remedial technologies recommended in the Phase II report.

Contaminants located within the existing structures on the site (including asbestos, lead-based paint, PCB's and animal feces) are the subject of separate Special Studies and are not addressed in this report.

1.5 ORGANIZATION OF REPORT

This report presents details of the field investigation activities conducted for SP-1 at SEFC. The cost estimate for handling and disposal of contaminated media has been prepared as a separate document from this report. The following ten sections are presented in this report in order to meet the objectives described above.

- Executive Summary

- Section 1.0: INTRODUCTION - Explains the objectives and scope of services for SP-1, and describes the organization of this report.

- Sections 2.0: SOILS INVESTIGATION and Section 3.0: GROUNDWATER INVESTIGATION - Details the field activities conducted at the site for soils and groundwater investigation, respectively.

- Section 4.0: QUALITY ASSURANCE PROCEDURES - Summarizes the quality assurance and quality control procedures employed during the investigation, and discusses the quality and limitations of the analytical data obtained.

- Section 5.0: REVIEW OF PRELIMINARY HEALTH RISK ASSESSMENT -Summarizes the review of the existing Preliminary Health Risk Assessment (PHRA) and its applicability to the current investigation.

- Section 6.0: ACTION LEVELS FOR SOILS AND GROUNDWATER - Presents the action levels that were selected for comparison of laboratory data.

- Section 7.0: FINDINGS AND RECOMMENDATIONS - Presents analytical results that exceed the action levels described in Section 6.0 and provides recommendations for the handling of these media.

- Section 8.0: VOLUMES OF MATERIAL REQUIRING SPECIAL HANDLING/DISPOSAL - Provides volume estimates of material requiring remediation or special handling/disposal.

- Section 9.0: REFERENCES - Summarizes the references used in developing this report.

1.6 SITE HISTORY

The Washington Navy Yard was established around 1800 primarily as an area for shipbuilding activities. Expansion of the Navy Yard towards the west occurred between 1800 and the early 1940s to include the current SEFC site. A portion of the SEFC site (particularly eastern and southeastern portion) was created by filling the marsh adjacent to the Anacostia River in the early 1900s. Activities at the Navy Yard shifted from shipbuilding to ordnance production near the turn of the 20th century. Naval research and development activities were the primary activities conducted at the site during the World War II era. All ordinance manufacturing and production activities had ceased by 1962, and in 1963 the western portion of the Navy Yard (SEFC) was transferred from the Department of the Navy to the General Services Administration. Since 1963, activities at SEFC have included administrative offices, warehousing and storage space, laboratories and light industrial operations.

Were a full scan For Priority Pollutants - Done. VOC SVOC Metals

2.0
SOILS INVESTIGATION

This section describes the field procedures that were used during the current investigation of the near surface and subsurface soils at the site. These soils were investigated by advancing borings and obtaining soil samples for laboratory analysis. The majority of the borings were located to better define the vertical and lateral extent of constituents identified during previous investigations. For the purpose of this investigation, these soil borings were divided into the following three categories:

(1) Total petroleum hydrocarbon (TPH) contaminated soils;
(2) Polynuclear aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), arsenic (As), and lead (Pb) contaminated soils;
(3) An ESA Update investigation which included additional soil borings located in areas that were not previously investigated, and in areas near the site for the purpose of obtaining background data.

Sample handling/labeling requirements, utility clearance, and decontamination procedures were performed in general accordance with Standard Operating Procedures (SOPs) Nos. 1 through 3 of the Work Plan that was approved by GSA. Other SOPs followed during this investigation are referenced below where appropriate. The locations of the soil borings are shown on Plate 1. A summary of the soil borings is provided in Table 2-1, and boring logs are presented in Appendix A.

2.1 TPH CONTAMINATED SOILS INVESTIGATION

2.1.1 Objectives

Previous investigations at SEFC identified the presence of TPH contamination at levels exceeding the District of Columbia Environmental Regulation Administration action level of 100 ppm. Borings installed during the previous investigations did not fully delineate the lateral or vertical extent of TPH contaminated soils resulting in broad assumptions in estimating remedial costs.

The objective of this investigation was to more accurately define the lateral and vertical extent of petroleum contaminated soil that was identified during previous investigations. Results of this investigation have been used to more accurately estimate the remediation costs for these soils.

2.1.2 Sample Locations & Methods

Sixteen soil borings (designated SB-1 through SB-16) were advanced to depths of approximately 20 feet (6 meters). Soil samples were collected from these borings utilizing the hollow-stem-auger drilling method and split-spoon sampling techniques as described in SOP No. 4 of the Work Plan. Split-spoon samples were logged in the field and visually classified in general accordance with ASTM D-2488. Each sample was field-screened for volatile organic vapors with an organic vapor analyzer (OVA) and the concentrations recorded on the boring logs.

Four split-spoon samples from each boring location were uniformly split as grab samples and placed into two sets of sample jars. One grab sample from each depth interval was field screened for TPH according to USEPA Draft Method 4030 using immunoassay field kits as described in SOP No. 11. The corresponding splits from each depth interval were retained for possible laboratory analysis. One soil sample from each borehole was submitted to an off-site laboratory for TPH analysis by USEPA Method 8015 (modified). The laboratory samples were selected from the depth interval that appeared to be the most contaminated in each borehole based on the TPH immunoassay field test results.

2.2 PAH, PCB, As, and Pb CONTAMINATED SOILS INVESTIGATION

2.2.1 Objectives

Results of the Phase II ESA boring investigation identified polynuclear aromatic hydrocarbon (PAH), polychlorinated biphenyl (PCB), arsenic (As), and lead (Pb) soil contamination around SEFC. Concentrations of these contaminants exceeded Phase II ESA health risk-based action levels at several areas. Because the Phase II ESA borings did not fully delineate the lateral or vertical extent of each contaminated area (e.g., in several cases only one boring was used to delineate a contaminated area) broad assumptions were made when estimating the volume of soils requiring remediation.

The objective of this investigation was to better delineate PAH, PCB, As, and Pb contaminated soils in the areas identified during the Phase II ESA investigation. Results of this investigation have been used to confirm the Phase II ESA investigation results and to improve the reliability of the volume estimates of soils requiring remediation.

2.2.2 Sample Locations & Methods

A total of 94 borings (designated SB-17 through SB-110) were advanced to depths which generally ranged between 1 and 20 feet (.3 and 6 meters). The depths and locations of the borings were chosen based on the results of previous investigations.

Soil samples were collected from each boring at various depth intervals depending on the total depth of the borehole, the type of contaminant(s) expected, the thickness of surface asphalt/concrete, and the presence of subsurface obstructions. In general, 1 or 2 samples were collected from borings that were less than 10 feet (3 meters) deep, three samples were collected from borings that were between 10 and 15 feet (3 and 4.6 meters) deep, and four samples were collected from borings that were greater than 15 feet (4.6 meters) deep.

Soil samples from four soil borings were collected with a stainless steel hand-auger. Soil samples from the remaining borings were collected utilizing the hollow-stem-auger drilling method and split-spoon sampling techniques as described in SOP No. 4 of the Work Plan. Split-spoon samples were logged in the field and visually classified in general accordance with ASTM D-2488. Each sample was field-screened for volatile organic vapors with an organic vapor analyzer (OVA) and the concentrations recorded on the boring logs.

why

In areas where PAHs and PCBs are a concern, soil samples were collected and composited from the upper 4 to 6 feet (1 to 2 meters). Grab samples were collected from specific depth intervals at depths greater than six feet (two meters). The samples were then uniformly split and placed into two sets of sample jars. One of the split samples was used for PAH and/or PCB immunoassay field screening according to USEPA Draft Methods 4035 and 4020, respectively, as described in SOP No. 11 of the Work Plan. The second split sample was retained for possible laboratory analysis. Based on the field screening results, approximately 20% of the field screened samples were selected for laboratory analysis of PAH by USEPA Method 8100. The samples were selected to include approximately 50% negative and 50% positive PAH field screening results. As indicated in the Work Plan, a total of four samples were selected for laboratory analysis of PCBs by USEPA Method 8080.

In areas where Pb and As were of concern, split-spoon samples were composited from the approximate depth intervals specified in the Work Plan. These composited samples were sent for laboratory analysis of Pb and/or As by USEPA Method 6010-(trace).

2.3 ESA UPDATE SOILS INVESTIGATION

2.3.1 Objectives

Soil sampling conducted during the 1991 Phase II ESA field investigation was generally performed at locations roughly along a 250-foot (76 meters) grid pattern across the site, and at additional biased sampling locations. Several large areas were not sampled because of the wide grid spacing, access limitations, and other constraints encountered. Therefore, significant doubt existed as to whether the site had been adequately characterized.

An objective of this investigation was to obtain data from areas that were not previously investigated in order to better characterize the site, thereby reducing the risk of encountering new environmental problems during subsequent stages of the project. Discovering and addressing additional potential sources of contamination early in the project may prevent costly delays during construction.

2.3.2 Sample Locations & Methods

Twenty-one soil borings (designated SB-111 through SB-131) were drilled across the SEFC site to depths of 4 to 5.5 feet (1 to 1.7 meters). The depths and locations of the borings were selected based on findings and recommendations made in the Phase I and Phase II ESA reports.

Soil samples were collected using the hollow-stem-auger drilling method and split-spoon sampling technique as described in SOP No. 4 of the Work Plan. Split-spoon samples were logged in the field and visually classified in general accordance with ASTM D-2488. Each sample was field-screened for volatile organic vapors with an organic vapor analyzer (OVA) and the concentrations recorded on the boring logs.

Split-spoon soil samples were composited from each boring and placed in laboratory sample containers for analysis. One composite sample from each boring was submitted for laboratory analysis of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides and PCBs, and metals by USEPA Contract Laboratory Program (CLP) procedures. Soil for VOC analysis was composited by removing a portion of each split-spoon sample and immediately placing the soil in a sample container. The remainder of the soil from each split-spoon was then thoroughly mixed and placed into sample containers for other analyses.

In addition, background soil borings (SB-132 through SB-135) were advanced to depths of 5.2 to 12 feet (1.6 to 3.7 meters) in areas where influences from past site activities are believed to be minimal. Borings SB-132 and SB-133 were located in the eastern portion of the site as shown on Plate 1, and were advanced as described above. Borings SB-134 and SB-135 were located off-site at 626 E Street and 514 4th Street, respectively. These later borings were advanced using a hand auger and sampled from the auger bit. One composite soil sample was collected from the top and the bottom of each boring (total of eight). Each of the background soil samples was sent for the same laboratory analyses as described above.

3.0
GROUNDWATER INVESTIGATION

This section describes the field procedures that were used during investigation of the groundwater at the site. Both shallow (i.e., water table) and deep groundwater were investigated through the collection and laboratory analysis of groundwater samples. These samples were collected from both Hydropunch™ borings, and from monitoring wells installed during this investigation. The investigation was divided into the following two categories based on the objective of the sampling:

(1) Groundwater in the vicinity of MW-3, and
(2) Site-wide groundwater.

This investigation was conducted using a phased approach that involved Hydropunch™ sampling followed by expedited laboratory analysis. Results of the analyses were used to identify additional Hydropunch™ borings and monitoring well locations. Sample handling/labeling requirements, utility clearance, and decontamination procedures were performed in general accordance with Standard Operating Procedure Nos. 1 through 3 of the Work Plan. Other SOPs followed during this investigation are referenced below where appropriate. The locations of these Hydropunch™ borings and monitoring wells are shown on Plate 1. Tables 3-1 and 3-2 summarize the Hydropunch™ borings and monitoring wells installed for this investigation, respectively. Boring logs for these boreholes are presented in Appendix A. Monitoring well construction diagrams were prepared for each well and are presented in Appendix B.

3.1 MW-3 GROUNDWATER INVESTIGATION

3.1.1 Objectives

Volatile organic compounds (VOCs) were identified in a groundwater sample obtained from monitoring well MW-3 which was installed during the Phase II ESA investigation. Specific compounds detected included constituents commonly found in gasoline. Because the source and lateral extent of this groundwater contamination near monitoring well MW-3 could not be clearly defined during the Phase II ESA investigation, the original cost to remediate groundwater contamination was conservatively estimated.

The objective of this investigation was to better estimate the nature and extent of contamination in groundwater in the vicinity of well MW-3. Further delineation of groundwater contamination in this area provides additional information on possible source areas, the location of the contaminant plume and its impact on future construction activities, and the type of remediation that may be required for groundwater. This information has been used to revise the original cost estimate for groundwater remediation.

3.1.2 Hydropunch/Monitoring Well Locations & Methods

Groundwater samples were collected from twelve Hydropunch™ borings (HP-1 through HP-12) and seven monitoring wells (MW-3, MW-9 through MW-13, and MW-21) to investigate groundwater quality in the vicinity of MW-3. The shallow Hydropunch™ samples were collected from depths ranging from 8 to 36 feet (2 to 11 meters). The deeper Hydropunch™ samples were collected from depths ranging from 53 to 80 feet (16 to 24 meters). Two shallow wells (MW-13 and MW-21) and four deep wells (MW-9 through MW-12) were installed to investigate both the shallow and deep groundwater conditions, respectively.
Soil samples were collected from each Hydropunch™ and monitoring well borehole in order to characterize the subsurface conditions. The soil samples were collected utilizing the hollow-stem-auger drilling method and the split-spoon sampling technique as described in SOP No. 4 of the Work Plan. Split-spoon samples were logged in the field and visually classified in general accordance with ASTM D-2488. Each sample was field screened for volatile organic vapors with an OVA and the concentrations recorded on the boring logs. Representative samples from the continuously split-spooned borings were selected by a geotechnical engineer for determination of grain size distribution (sieve analysis) and Atterburg Limits according to ASTM Methods D-422 and ASTM D-4318, respectively. The results of these tests were used to confirm field soil classifications.

Monitoring wells were installed and developed in general accordance with SOP No. 6 of the Work Plan. The monitoring wells were constructed of 4-inch inside diameter, Schedule 40 PVC casing and 0.020 inch machine-slotted screen. Ten to twenty feet (three to six meters) of well screen were installed with a No. 2 sand pack extending approximately 3 feet (1 meter) above the top of the screen. A 3-foot (1 meter) bentonite seal was installed on top of the sand pack. The remainder of the annular space was filled with a cement/bentonite grout. Each well was completed with a locking cap and a flush mount protective casing. Following completion, each well was developed either by over-pumping and surge block, or by air-lift and surge block techniques.

Groundwater samples were collected from the 12 Hydropunch™ borings, the six newly installed monitoring wells, and from existing monitoring well MW-3 in accordance with SOP Nos. 5 and 7 of the Work Plan. With the exception of HP-6, Hydropunch™ groundwater samples were collected at two depth intervals. One groundwater sample was collected when groundwater was first encountered (i.e., water table). The second groundwater sample was collected from depths varying from 53 feet to 80 feet (16 to 24 meters), and was intended to assess possible downward migration of contaminants through groundwater. Attempts to collect the deep sample at MW-6 were unsuccessful due to geologic conditions that resulted in minimal yield of groundwater to the Hydropunch™ sampler.

Hydropunch™ groundwater samples were analyzed at an off-site laboratory for VOCs by USEPA Method 8240 and for unfiltered lead by USEPA Method 6010-(trace). Groundwater samples from wells MW-9, MW-10, MW-12, MW-13, and existing well MW-3 were analyzed for VOCs by USEPA Method 8240, filtered lead by USEPA Method 6010 -(trace), and TPH by USEPA Method 8015 (modified). Groundwater samples from wells MW-11 and MW-21 were analyzed for VOCs by USEPA Method 8240, Target Compound List (TCL), semivolatile organics (SVOCs) by USEPA Method 8270, and filtered Target Analyte List (TAL) metals by USEPA Method 6010-(trace). The water sample from MW-21 was also analyzed for TPH by USEPA Method 8015 (modified).

3.2 SITE-WIDE GROUNDWATER INVESTIGATION

3.2.1 Objectives

A total of eight monitoring wells were installed and sampled to various depths during the Phase II ESA investigation. Although the Phase II ESA investigation indicated that groundwater quality beneath the site was generally acceptable based on the limited sampling results, the surface and subsurface soil contamination identified during the investigation, as well as the contaminated groundwater found in monitoring well MW-3, suggested further groundwater investigation was warranted.

The objective of the site-wide groundwater investigation was to identify groundwater contamination, if any, at areas of the site where groundwater quality data were not available. This information has been used to consider site worker health and safety issues and groundwater disposal considerations during dewatering activities that could cause unexpected costs and delays during construction.

3.2.2 Hydropunch/Monitoring Well Locations & Methods

Groundwater samples were collected from 29 Hydropunch™ borings (HP-13 through HP-41) and nine monitoring wells (MW-11, MW-14 through MW-21) to investigate groundwater quality throughout SEFC. The Hydropunch™ borings were advanced to a total depth ranging from 53 to 80 feet (16 to 24 meters). Three shallow wells (MW-14, MW-19, and MW-21) and six deep wells (MW-11, MW-15 through MW-18, and MW-20) were installed to investigate both the shallow and deep groundwater conditions, respectively.

The Hydropunch™ borings and monitoring wells were located in the vicinity of the following eight areas, which were identified during review of the 1991 Phase II ESA field investigation as requiring further study.

- Tank 04/05 Area
- Area West of Building 202
- Area Adjacent to the Anacostia River

- Areas Near Borings K&D 10, K&D 28, K&D 31, and K&D 32
- Area near APEX Boring B-5
- Area near APEX Boring A-13
- Area near APEX Boring A-11
- Area near APEX Boring A-16 and K&D Boring 38

Soil samples were collected from each Hydropunch™ and monitoring well borehole in order to characterize the subsurface conditions. The soil samples were collected utilizing the hollow-stem-auger drilling method and the split-spoon sampling technique as described in SOP No. 4 of the Work Plan. Split-spoon samples were logged in the field and visually classified in general accordance with ASTM D-2488. Each sample was field screened for volatile organic vapors with an OVA and the concentrations recorded on the boring logs. Representative samples from the continuously split-spooned borings were selected by a geotechnical engineer for determination of grain size distribution (sieve analysis) and Atterburg Limits according to ASTM Methods D-422 and ASTM D-4318, respectively. The results of these tests were used to confirm field logging classification and support the geotechnical analyses across the site.

Monitoring wells were installed and developed in general accordance with SOP No. 6 of the Work Plan. The monitoring wells were constructed of 4-inch inside diameter, Schedule 40 PVC casing and 0.020 inch machine-slotted screen. Ten to twenty feet (three to six meters) of well screen were installed with a No. 2 sand pack extending approximately 3 feet (1 meter) above the top of the screen. A 3-foot (1 meter) bentonite seal was installed on top of the sand pack. The remainder of the annular space was filled with a cement/bentonite grout. Each well was completed with a locking cap and a flush mount protective casing. Following completion, each well was developed either by over-pumping and surge block, or by air-lift and surge block techniques.

Groundwater samples were collected from the Hydropunch™ borings and the monitoring wells in accordance with SOP Nos. 5 and 7 of the Work Plan. With the exception of two Hydropunch™ borings (HP-22 and HP-38) Hydropunch™ groundwater samples were collected at two depth intervals. One groundwater sample was collected when groundwater was first encountered (i.e., water table). The second groundwater sample was collected from depths varying from 73 feet to 80 feet (22 meters to 24 meters), and was intended to assess possible downward migration of contaminants through groundwater. Attempts to collect the shallow groundwater samples at HP-22 and HP-38 were unsuccessful due to geologic conditions that resulted in minimal yield of groundwater to the Hydropunch™ sampler. In addition, the deep sample at HP-38 was collected from a depth of approximately 55 feet (17 meters) due to auger refusal (possible presence of a boulder).

Hydropunch™ groundwater samples were analyzed at an off-site laboratory for VOCs by USEPA Method 8240, SVOCs by USEPA Method 8270, and for unfiltered metals by USEPA Method 6010-(trace). Groundwater samples from the monitoring wells were analyzed for VOCs by USEPA Method 8240, SVOCs by USEPA Method 8270, and for filtered metals by USEPA Method 6010-(trace). The water sample from MW-21 was also analyzed for TPH by USEPA Method 8015 (modified).

4.0
QUALITY ASSURANCE PROCEDURES

4.1 OVERVIEW OF QUALITY ASSURANCE (QA) PROGRAM

A Quality Assurance (QA) Program was developed for the SEFC to verify the integrity and reliability of protocols associated with the site investigation. The program encompassed thorough planning, continuous application of quality control (QC) measures to preclude out-of-control occurrences, and the establishment of monitoring systems to ensure that deficiencies were identified, evaluated and corrected.

The Quality Assurance Program was implemented through the integration of well defined quality control protocols for all activities associated with the task assignment. The quality control criteria defined for sampling and analysis activities were developed in accordance with USEPA guidelines. Quality control criteria for project activities not defined in previous documents were developed for the project by W-C using the data validation functional guidelines which were prepared by the USEPA. Standards of quality were maintained through adherence to standard operating procedures (SOPs), periodic monitoring of sampling and analysis activities, and frequent evaluations of management activities.

- what level Full ?

Level III and Level IV (USEPA, 1987) laboratory analyses and data deliverables were selected to meet the objectives for this project. In addition to the laboratory analyses conducted for this project, W-C performed field screening for total petroleum hydrocarbon (TPH), polychlorinated biphenyls (PCBs), and polynuclear aromatic hydrocarbons (PAHs) on selected soil samples using immunoassay techniques to produce Level I data that were used to select samples for confirmatory laboratory analysis.

4.2 OVERVIEW OF QUALITY CONTROL MEASURES

QC criteria were defined for sampling and analysis activities in accordance with USEPA guidelines. Data validation was performed according to the USEPA Region III Modifications to the National Functional Guidelines for Organic Data Review and

USEPA Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses. The QC measures used to ensure the integrity of data for this project are described below:

- **Project Planning and Site Characterization.** A site reconnaissance was conducted prior to finalizing the work plan for the ESA Update. Information concerning current and past activities pertinent to site characterization was gathered and sampling locations were determined. Historical information, such as site maps, was also obtained.

- **Project Work Plan Development.** W-C prepared a Work Plan that included three separate components: the Sampling Design Plan (SDP), the Quality Assurance Plan (QAP), and the Health & Safety Plan (HSP). SOPs were specified in the SDP to guide the conduct of field work. All three plans were approved by GSA and FCA before work began.

- **Standard Operating Procedures.** Sampling activities were conducted in accordance with the SOPs defined in the SDP. Copies of the SOPs were given to all individuals responsible for providing technical support to the project. Field personnel were familiar with the protocols associated with the project sampling scenarios. Chemical analyses were performed using the analytical methods summarized in Table 4-1.

- **Documentation.** Field activities were documented with forms developed by W-C containing the information required for encoding chemical and geotechnical data into a database suitable for this investigation. Analytical samples were collected and relinquished under the chain-of-custody protocols defined in the project Work Plan.

- **Sampling Personnel.** Field team members possessed the appropriate qualifications and training and were familiar with the protocols for collecting environmental samples and performing tasks. All team members were provided copies of the Work Plan to familiarize themselves with planned field activities prior to the commencement of work.

- **Analytical Services.** American Environmental Network Incorporated (AENI) located in Columbia, Maryland, was chosen through a competitive bid process to provide the analytical services for this project. Samples were analyzed for organic and inorganic compounds using USEPA SW-846 and CLP protocols.

  AENI provided the following to the sampling team: deionized water used during the decontamination process and as field QC blanks, sample containers cleaned in accordance with USEPA guidelines, appropriate preservatives required to retard chemical degradation of the samples, and shipping containers capable of maintaining an internal ambient temperature of approximately 4° C during transit from the site to the laboratory.

- **Field Screening.** Field screening was performed on selected soil samples for either TPH, PAHs, PCBs, or a combination of the three. Based on the field screening results, several samples were selected for laboratory analysis to confirm field screening results.

- **Data Assessment.** QC samples such as field and trip blanks and field duplicates were collected and analyzed along with environmental samples to determine the reliability of the chemical analyses. A discussion of the parameters evaluated for data assessment is presented in Section 4.5.

4.3 FIELD QUALITY CONTROL MEASURES

4.3.1 QC Sample Collection

QC samples were collected to measure the precision and accuracy of the field sampling team and the analytical system. During this investigation, a total of 13 field duplicate pairs, 10 matrix spike/matrix spike duplicate (MS/MSD) pairs, 14 rinsate blanks, and 39 trip blanks were collected. A detailed data evaluation is discussed in Section 4.4 and a summary of the analyses performed on these QC samples is presented in Table 4-1.

4.3.2 Field Audit

A field audit was conducted of field activities on July 7, 1995 to verify that all pertinent SOPs were being followed appropriately. Field activities observed included the purging of monitoring wells; the collection, containerizing, and labeling of groundwater samples for chemical analysis; and the handling of derived wastes. The auditor concluded that all activities were conducted in accordance with the protocols described in the Work Plan, including the appropriate SOPs.

4.3.3 Nonconformance and/or Other Technical Issues

During the Hydropunch™ sampling, metals samples were not filtered prior to acidification with nitric acid. Due to the high percent solids of these samples, the Hydropunch™ samples may not provide a good representation of site groundwater conditions, because the nitric acid may have leached and digested some metal analytes that are adsorbed on the heavier particulates. This may have resulted in the reporting of higher metals concentrations than are actually present in the groundwater. Since the Hydropunch™ samples were only collected for screening purposes and to guide the geologists during well placement, no action was taken. The data were not used to evaluate exceedences of action levels. However, all well samples were filtered soon after they were collected and preserved on-site with nitric acid. For this reason, W-C believes that the reported metal concentrations for the monitoring well samples are a better indicator of actual site groundwater conditions.

4.4 ANALYTICAL SERVICES

4.4.1 Laboratory Information

Chemical analyses were performed by AENI Laboratories in Columbia, Maryland using USEPA SW-846 methods and current USEPA Contract Laboratory Program (CLP) protocols. These protocols require the laboratory to document various QC measures in order to demonstrate sound analytical performance. These QC measures were evaluated against guideline criteria. QC criteria for calibrations are specified by the analytical method. Instrument calibration is required to ensure that the instruments are capable of producing acceptable quantitative data. Calibration verification is accomplished through instrument performance checks, initial and continuing calibration checks. The analysis of blanks is performed to determine the existence and magnitude of possible laboratory contamination. The lab was required to re-analyze samples with poor system monitoring compound (SMC) or internal standard (IS) recoveries to confirm matrix effect and report both sets of analytical results. The analytical results that were deemed to be more acceptable, according to the Functional Guidelines, were submitted in this report. As a part of their internal QC process, the laboratory was responsible for ensuring that LCS/DCS (Laboratory Control Samples/Duplicate Control Samples) were within the control limits specified by the method and applicable standard operating procedure. The laboratory was responsible for ensuring the quality of data acquired during chemical analysis. Optimum performance was obtained through frequent evaluations of performance and system audits, preventive maintenance, and corrective action.

4.4.2 Analytical Data Information

All data packages received at W-C were checked for completeness. Data in electronic format were first scrutinized using Excel or Paradox, then uploaded into W-C's database system, Sample Manager Professional (SMPro). SMPro is a database management application used to expedite the processes involved in administering chemical and geological/soil sampling. All chemical data from this project are stored in this database and can only be accessed by project-designated users.

4.5 DATA QUALITY ASSESSMENT

All of the data were evaluated with respect to pertinent criteria specified by SW-846 and CLP protocols. The purpose of the assessment was to determine precision, accuracy, completeness, comparability, representativeness, and useability of the data associated with sample collection and laboratory analyses. In addition, data were assessed through the evaluation of laboratory performance associated with analytical, instrumental, and compound identification QC criteria. The following elements were reviewed and checked during data quality assessment of the laboratory analytical reports: holding times, methodology, calibrations, quantitation and detection limits, QC samples, blanks (trip, field, and method blanks), surrogate compounds, and duplicate samples.

4.5.1 Data Evaluation Procedures

The data quality review and validation were performed in accordance with the project QAP and the guidance provided in the USEPA Region III Modifications to the National Functional Guidelines for Organic Data Review and USEPA Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses. Where necessary, professional judgement was used in determining the need for data qualification.

The reliability of the data was assessed through the evaluation of statistical data quality indicators such as precision, accuracy, and completeness. These indicators were used to qualify the data generated for decision-making purposes.

4.5.2 Precision

Precision is defined as a measurement of the reproducibility of data under a specified set of conditions. It is a quantitative measure of the variability of a group of measurements compared to the group mean measurement. Analytical precision was assessed through the evaluation of matrix spike, field, and laboratory duplicates, as appropriate. Thirteen (13) field duplicate samples and 10 MS/MSD pairs were collected for this project.

The analytical results from the duplicate and corresponding field sample were compared by determining the relative percent difference (RPD) between the two sets of data. According to USEPA guidelines, an RPD control limit of ±20% for aqueous samples (35% for soil) should be used for duplicate sample values greater than 5 times the CRDL (Contract Required Detection Limit) or ±CRDL for aqueous samples (±2 times CRDL for soil) if the duplicate sample values are less than 5 times CRDL. Although these criteria were only established for laboratory duplicate analyses for metals, the principle can be applied to all duplicate analyses.

Since there are no published review criteria established for field duplicates, a control limit of ±35 percent was used as the guideline for this project. A comparison of the RPDs for the field duplicate samples is presented in Tables 4-2(a) through Table 4-2(m). Fewer than half of the RPDs exceeded the 35 percent criterion. This is generally acceptable since field duplicate samples are likely to have more variability than laboratory duplicates. It is also expected that non-filtered Hydropunch™ and soil samples would have a greater variance than monitoring well samples due to difficulties associated with collecting identical field samples and obtaining homogeneous aliquots in the laboratory. Furthermore, the majority of the outliers were qualified as either "J" (estimated), "L" (estimated with a low bias), or "K" (estimated with a high bias). There may also be analytical interferences due to the complexity of the different matrices.

The RPDs of the MS/MSD pairs were evaluated to measure the reproducibility (precision) of the analytical system. No major issues were encountered for these pairs.

4.5.3 Accuracy

Accuracy is defined as a measurement of the bias in a system. It is expressed as the percentage variance in an observed measurement from the value of the parameter. Potential sources of error include the sampling process, field contamination, preservation, sample management, sample matrix, sample preparation, and analysis technique. Sampling accuracy was assessed through the evaluation of field, rinsate and trip blanks. Rinsate blanks and trip blanks were assessed to determine the impact of contamination contributed from sampling activities. Analytical accuracy was assessed through the evaluation of percent recoveries associated with QC samples. Clearly defined criteria for acceptance exist under SW-846 and CLP protocols. The lab was responsible for performing a QA review prior to releasing any data.

Accuracy was determined to be acceptable for most analyses. Accuracy results that did not fall within established QC limits were detailed in the case narrative of each SDG and data validation summaries appeared to have not adversely impact the quality of data.

4.5.4 Completeness

Completeness is defined as a measure of the amount of valid data obtained from a measurement system relative to the amount that was expected to be obtained under correct operating conditions. The completeness for this investigation was determined to be well above the 90% level typically achieved by the CLP. The samples which were proposed were collected and the type and number of analyses to be performed were similar to those specified in the Work Plan.

4.5.5 Comparability and Representativeness

Comparability and representativeness were addressed by adherence to QC procedures and sampling and reporting procedures outlined in the SOPs. The sample collection and analysis methods and the data reporting procedures have remained fundamentally similar to the QA program so that the comparability of the data has not been compromised.

4.6 DATA REVIEW SUMMARY

The analytical data deliverables were prepared by the laboratory in EPA Level III and Level IV data packages. USEPA Region III Modifications to the National Functional Guidelines for Organic Data Review and USEPA Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses were used as guidance for data validation. Method specifications were used as guidance on data validation for analyses where no guidelines were available.

Several compounds for volatile, semivolatile, and metal fractions the detected concentrations of these compounds in the corresponding samples were qualified or rejected due to outlying laboratory QC parameters (internal standard, surrogate recovery, spike recovery, etc.). Most of the affected compounds were qualified as estimated. All rejected samples are listed in Table 4-3a through Table 4-3c.

4.7 QC BLANK ASSESSMENT

4.7.1 Method Blanks

4.7.1.1 Volatile Organic Compounds

Methylene chloride and acetone, common laboratory contaminants, were detected at maximum levels of 17 mg/L and 4.4 mg/L, respectively. In addition, 2-butanone and 2-hexanone were detected at maximum levels of 22 mg/L and 1.1 mg/L, respectively. All associated samples were qualified according to guidance.

4.7.1.2 Semivolatile Organic Compounds

Bis(2-ethylhexyl)phthalate, a common laboratory contaminant, and dibenz[a,h]anthracene were detected at maximum levels of 230 mg/L and 45 mg/L, respectively.

4.7.1.3 Metals

Zinc and iron were the typical metals detected in a majority of the method blanks. The maximum concentrations of these two compounds were 30 mg/L and 107 mg/L, respectively. However it should be noted that only the CLP and monitoring well inorganic data were reported down to the instrument detection limit (IDL). This discrepancy suggests that there may have been more method blank contamination during analysis than reported because the results were reported down to the CRDL not the lowest detection limit, the IDL.

4.7.1.4 Pesticides/PCBs

4,4'-DDD and methoxychlor were detected at maximum levels of 3.4 mg/L and 27 mg/L, respectively.

4.7.2 Rinsate Blanks

The rinsate blanks contained several target compounds. The majority of the compounds detected in the rinsate blanks were metals. These compounds were detected mainly in the Hydropunch™ samples. This could have been a result of poor decontamination practice or a communication failure between the sampling crew. Although each rinsate blank was assigned a designated location, the sampling devices were transferred from rig to rig. Due to these sampling equipment transfers, W-C was unable to isolate the rinse blank contamination to specific samples. For this reason, W-C decided to use the highest detections from all rinsate blanks of the same media (soil, Hydropunch™, or monitoring well) and qualify all associated samples across the board. The compounds detected in the rinsate blanks with their corresponding concentrations are presented in Table 4-4(a) through 4-4(c).

4.7.3 Trip Blanks

Only methylene chloride was detected at a maximum level of 38 mg/L. No other compounds were detected.

4.8 LIMITATIONS OF THE ANALYTICAL DATA

Careful consideration should be applied when using the metal Hydropunch™ results since these results might be higher than values actually present in the groundwater samples. This assumption is based on the fact that these metal samples were not filtered on-site and acidified prior to shipment to the laboratory for chemical analysis. The on-site acidification process might have dissolved the inorganic elements from particulates suspended in the water sample. This would normally increase the concentration of the analytes previously present in the groundwater.

There was one problem with the TPH analysis that should be addressed. W-C requested analysis for TPH by USEPA Method 8015 Modified for diesel range organics. In many cases the laboratory qualified the reported concentration of TPH in the samples with an H and/or S qualifier. The H and S qualifiers indicate the presence of hydrocarbons that are heavier or lighter than diesel, respectively. EPA 8015 Modified requires that the compounds be quantitated using a diesel standard only. Although the results reported with H or S qualifiers are not diesel, they were quantitated using a diesel standard by considering only the portion of the sample chromatogram that coincides with the diesel standard chromatogram. Therefore, the results with these qualifiers should be viewed as estimated. The actual concentrations of the samples with H or S qualifiers are likely higher than the concentrations reported, because the reported values reflect only a portion of the sample concentration.

4.9 CONCLUSIONS

An assessment of the results of the QA program and QC measures indicates that field and laboratory procedures established for this investigation have been followed. In addition, the data reported are valid and usable, as qualified (with the exception of rejected results).

Rejected results included the following: (1) semivolatile acid fractions of samples SB-120 and SB-130 (Table 4-3a); (2) semivolatile fractions for samples HP-28 at 9-11 feet (2-3 meters) and HP-32 at 11-13 feet (3-4 meters) (Table 4-3b); (3) antimony, arsenic, selenium, silver, and thallium for several samples listed in Table 4-3c. These data were rejected typically because of extremely low surrogate (organic) or matrix spike (metal) recoveries. Reduced instrument sensitivity indicated by severely low internal standard recoveries was another factor resulting in data rejection.

The majority of the data, with the exception of the Hydropunch™ samples for metals analysis and those data points that were rejected, are considered acceptable to quantitatively assess analyte concentrations and determine the presence of contamination in the areas sampled.

5.0
REVIEW OF PRELIMINARY HEALTH RISK ASSESSMENT

A preliminary health risk assessment (PHRA) was performed in 1991 by K&D as part of the Phase II ESA subsurface investigation conducted at the Southeast Federal Center. The PHRA quantitatively examined the potential health risks associated with exposure of two receptor groups (on-site workers and older children trespassers) to site soils through ingestion and dermal contact under baseline or "no action" conditions. Other potential exposure pathways were discussed qualitatively. The chemical analytical results from six discrete sample locations were used to represent exposure point concentrations.

The conclusions of the PHRA were that excess cancer risks for two receptor groups did not exceed the 1×10^{-4} to 1×10^{-7} risk range (USEPA's current "acceptable" risk range is 1×10^{-4} to 1×10^{-6} (USEPA, 1990)). These cancer risks were contributed largely by carcinogenic polynuclear aromatic hydrocarbons (PAHs). All non-carcinogenic Hazard Indices were below the acceptable threshold comparison value of 1.0. Therefore, unacceptable health risks and hazards were not posed by the site for the receptor groups. K&D termed the PHRA "preliminary" because the analytical data were not validated prior to use.

The PHRA was reviewed to evaluate its technical adequacy and to determine its use in guiding current site activities. The conclusion of the review is that the PHRA does not currently describe baseline risks at the site partially because of limited scope, and now outdated approaches. The PHRA should no longer be used to guide decision-making at the SEFC site.

AGREE BUT CONSIDERING THE RELEASE
IN LIGHT OF CONSTRUCTION PROJECT

Material handling activities anticipated for the SEFC will largely be driven by construction needs, rather than remediation needs. This is due to the excavations required for the large area of multi-level below grade parking structures. Therefore, a risk-based evaluation of site media that recognizes planned construction activities and differentiates between soils that will be excavated and those that will remain in place should be used in place of the K&D risk assessment. This risk-based evaluation is presented in Section 6 of this report.

6.0
ACTION LEVELS FOR SOILS AND GROUNDWATER

Proposed construction activities at the Southeast Federal Center will result in (1) the removal of large quantities of excavated soil from block areas for underground parking and foundations, and (2) removal of lessor quantities of soil from walkways and roadways between buildings. The potential risks associated with exposure to these soils, both those removed from the site and those remaining after construction is complete, are evaluated in this section to identify the appropriate management approaches. A decision process has been developed for this evaluation, and is presented in Figure 6-1.

6.1 APPROACH TO EVALUATING EXCAVATED SOILS

It is most cost effective to handle the soil to be excavated as general fill material requiring no special use limitations, whenever possible. Analytical results of the three available data sets (W-C, K&D, and Apex) were evaluated in order to evaluate whether the excavated soil can be used as general fill. The soil data sets evaluated are presented in Appendix C.

A three tiered approach of evaluating the excavated soils was applied. In Tier I, applicable regulations and acceptable health-based soil concentrations of chemicals for a ***residential land use*** scenario were identified (Tier I action levels). A residential land use scenario was considered to be an appropriate basis to initially screen excavated soils since application of these soils to residential properties is possible, if soils are removed from the site for use as fill with no use limitations. The Tier I action levels were compared to the available site data on a sample by sample basis. Soils with chemical concentrations below Tier I action levels were judged to be acceptable for use as general fill.

Soils containing chemical concentrations in excess of the Tier I action levels were examined further in the residential Tier II evaluation with regard to the following factors:

- Frequency of the exceedence: low (one or two detections), moderate (two to five detections) or high (over five detections);
- Magnitude of the exceedence: low (two times the action level or less), moderate (between two to five times the action level) or high (greater than five times the action level);
- Presence of an action level exceedence in associated groundwater.

If, based on the residential Tier II evaluation, exceedence of the action level is judged to be insignificant, then these soils are also acceptable for use as general fill. Excavated soils failing the Tier II criteria may require alternate management. As a third tier, the chemical concentrations exceeding residential ALs are compared with commercial/occupational action levels to provide information on options for management.

6.2 APPROACH TO EVALUATING REMAINING SOILS

Soils located outside or beneath the limits of excavation will remain on site after construction activities are completed. The SEFC complex will contain office buildings and similar features, and is best described as commercial/industrial land use. A pedestrian walkway along the riverfront is also planned. It is possible that much of the remaining soil will be paved or covered, limiting the potential exposure of future SEFC employees and visitors to the soils. Potential exposure to remaining soils by commercial, occupational, or recreational exposure will be less frequent than that potentially occurring to those excavated soils subject to residential exposure.

Remaining soils that contained chemical concentrations below the residential or commercial/industrial action levels were judged to be acceptable for leaving in place with no additional action. Soils exceeding commercial/industrial action levels may require alternate management, such as removal. ! NOT RESIDENTIAL

Groundwater quality at the site is also examined in this report. Groundwater chemical concentrations were compared with regulatory or health-based action levels to evaluate whether the groundwater requires remedial treatment. Identification of soil and groundwater action levels are discussed below.

6.3 SOIL ACTION LEVELS

Tier I action levels for soil were identified for most organic and inorganic constituents that were identified in site soil samples. The approach used to identify or calculate action levels is described below. The action levels applied to evaluate excavated (residential) and remaining (commercial/industrial) soils at the Southeast Federal Center are summarized on Tables 6-1 and 6-2, respectively.

6.3.1 Residential Soil Action Levels for Organic Chemicals

Residential Tier I action levels for most organic chemicals were obtained from the USEPA generic Soil Screening Levels (SSLs) for Superfund (USEPA, 1994a; USEPA, 1994b) (Appendix D). In this draft guidance, USEPA has developed up to three SSLs for a large number of chemicals. The first SSL identifies soil concentrations that are associated with acceptable cancer risks (at a 1×10^{-6} or one-in-one-million cancer risk level) or non-carcinogenic health hazards (at a hazard quotient of 1) when exposure occurs through soil ingestion under conservative, residential land use assumptions. The second SSL identifies soil concentrations that are acceptable when exposure occurs through inhalation under conservative, residential land use assumptions. The third SSL identifies soil concentrations that are protective of groundwater quality (i.e., evaluates the leaching potential of the chemical), using either a Safe Drinking Water Act maximum contaminant level (MCL) or conservative risk-based value, to define acceptable groundwater concentrations. The lowest of the three USEPA SSL values for a chemical was selected for use as a residential Tier I action level.

Health-based residential action levels were calculated for organic chemicals detected at the site that did not have USEPA SSLs for the ingestion, inhalation, and leaching potential pathways. The lowest, or most conservative, of the three health-based values was used as the action level. Calculation of health-based action levels is presented in Appendix E. Did not evaluate the appropriateness of this calculation

Refined residential action levels associated with a 1x10^{-4} risk level were derived for fourteen organic chemicals for use as an action level rather than the USEPA SSL level based on a 1x10^{-6} risk level or a non-risk-based value (such as an MCL). These chemicals were:

- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Chrysene
- Dibenz(a,h)anthracene
- Indeno(1,2,3-cd)pyrene
- Bis(2-chloroisopropyl)ether
- Carbazole
- 3,3'-Dichlorobenzidine
- n-Nitrosodiphenylamine
- Aldrin
- beta-BHC
- Dieldrin

Don't agree. The levels are not acceptable but are within a Risk Range that Require a Risk management Decision - would Prefer a calc on 10^{-6}

USEPA has defined cumulative cancer risks for reasonable maximum exposures within the range of 1x10^{-4} (one-in-ten-thousand risk) to 1x10^{-6} as acceptable (USEPA, 1991a). Therefore, these refined action levels for these 14 organic chemicals are also acceptable and protective.

Action levels could not be derived for six detected organic chemicals because of the lack of USEPA toxicity values. These chemicals are: bis(chloroethoxy)methane, 4-bromophenylphenylether, 4-chlorophenylphenylether, 4-nitrophenol, delta-BHC, and total phenols.

6.3.2 Residential Soil Action Levels for Inorganic Constituents

Residential soil Tier I action levels for inorganic constituents were identified in the same manner as for organic chemicals, with the additional consideration of background. First, USEPA SSLs were identified from the draft guidance or action levels were calculated according to the SSL methodology, as previously described. The lowest (most conservative) of the ingestion, inhalation, or leaching potential SSL or calculated SSL was identified. Second, a 95% upper confidence limit (UCL) on the background mean concentration of each metal was calculated and is shown on the data tables presented in Appendix C. The higher of the 95% UCL concentration or the lowest SSL/calculated SSL was used as the residential Tier I action level for inorganic constituents. A refined residential Tier I action level was calculated for arsenic, associated with a $1x10^{-4}$ risk level.

A residential Tier I action level of 100 mg/kg was applied for nickel rather than the USEPA SSL or the 95% UCL of background. The lowest USEPA SSL for nickel is 21 mg/kg, based on protection of groundwater, and was judged to be overly stringent. This concentration of 100 mg/kg falls within typical background levels of nickel in the eastern United States, ranging from <5 to 700 mg/kg, with an arithmetic mean value of 18 mg/kg (USGS, 1984). Site-specific background measurements of nickel were rejected because of QA/QC violations, so a 95% UCL background concentration could not be calculated. The value of 100 mg/kg was subjectively selected based on information on ranges of typical nickel background levels. USEPA's SSL for nickel associated with soil ingestion is 1,600 mg/kg and the SSL for inhalation is 6,900 mg/kg. This residential Tier I action level is conservatively protective of both of these pathways.

6.3.3 Residential Soil Action Level for Total Petroleum Hydrocarbons

The residential soil Tier I action level selected for total petroleum hydrocarbons (TPH) was 10 mg/kg. This value is the District of Columbia Environmental Regulations Administration's (DCERA's) maximum permissible TPH concentration for fill material specified by guidance issued by the District of Columbia (September 1994).

many more RBC than SSL's

6.3.4 Commercial/Industrial Soil Action Levels for Organic Chemicals

Commercial/industrial action levels for soils were identified for organic chemicals exceeding residential Tier I action levels. Commercial/industrial action levels are chemical concentrations associated with acceptable risk levels (a cancer risk level of $1x10^{-4}$ and a non-carcinogenic hazard quotient of 1) under conservative occupational exposures. Two exposure pathways were used to derive commercial/industrial action levels (soil ingestion and soil inhalation), using USEPA's default worker exposure assumptions (USEPA, 1991b). The lower, or most conservative, of these two values was used as the action level. The potential for soils to leach to groundwater was not used as a basis for commercial/occupational action levels, since these values are based on the assumed use of the groundwater for potable purposes. Groundwater at the SEFC is not currently used for potable purposes, and is not anticipated to be used for potable purposes in the foreseeable future. It will also be somewhat protected from leaching soils due to the substantial surface cover over most of the site. The commercial/industrial action levels are presented on Table 6-2; calculation of the commercial/industrial action levels is contained in Appendix G.

The commercial/industrial action level for polychlorinated biphenyls (PCBs) is 10 mg/kg. This value is the lower end (most conservative) of the range of PCB concentrations that USEPA has identified as acceptable for industrial soils (10 to 25 mg/kg) (USEPA, 1990).

6.3.5 Commercial/Industrial Soil Action Levels for Inorganic Chemicals

Commercial/industrial action levels for soils were identified for inorganic chemicals exceeding residential Tier I action levels. These values were derived in the same manner as discussed in the preceding section for organic chemicals, (i.e., are based on conservative occupational exposures). These action level values are presented on Table 6-2.

Lead - 400 mg/kg - 15 ug/L G.W

The commercial/industrial action level for lead is 5,000 mg/kg. This value is the concentration above which soil abatement is recommended in residential settings under the Toxic Substances Control Act (TSCA) Section 403.

6.3.6 Commercial/Industrial Soil Action Levels for Total Petroleum Hydrocarbons

The commercial/industrial action level for TPH is 100 mg/kg. This value is the District of Columbia's TPH concentration below which the District requires no additional assessment or remediation provided the soils remain in place, as specified in the District of Columbia Municipal Regulations (20 DCMR 6212).

6.4 GROUNDWATER ACTION LEVELS

Action levels (action levels) for chemicals in groundwater were obtained from two sources: USEPA National Primary Drinking Water Standards (MCLs); or, for detected chemicals without MCL values, risk-based values derived under the assumption of residential consumption of the water, set equal to a cancer risk level of $1x10^{-6}$ or a hazard quotient of 1, using USEPA's default exposure factors for groundwater ingestion (USEPA, 1991b). Table 6-3 presents the groundwater action levels for chemicals detected groundwater samples collected from in site monitoring wells; calculation of groundwater action levels is presented in Appendix H.

Groundwater quality is evaluated by comparing chemical concentrations detected in samples collected from monitoring wells with the groundwater action levels.

7.0
FINDINGS AND RECOMMENDATIONS

7.1 GEOLOGIC AND HYDROGEOLOGIC SETTING

Regional and local site geology/hydrogeology information was collected during this investigation. All borings from this investigation were logged in the field from soil cuttings and split-spoon samples. Representative samples were selected for testing of geotechnical properties (i.e., sieve analysis and Atterberg Limits), and boring logs were modified based on the results. This information was supplemented by data from previous site investigations and literature on local geology/hydrogeology. These sources are referenced in Section 9.0 of this report. Boring logs, monitoring well construction diagrams, and results of the geotechnical analytical testing are included in Appendices A, B, and H respectively. Three geologic profiles (A-A', B-B', and C-C') were constructed across the site from selected soil borings (locations shown on Figure 7-1) and are presented as Figures 7-2 through 7-4.

7.1.1 Geology

The SEFC site is located within the Atlantic Coastal Plain Physiographic Province which is characterized by sequences of marine and terrestrial sedimentary deposits. The western limit of the province is commonly referred to as the Fall Line, where older crystalline rocks of the Piedmont Province begin to dip beneath the relatively new sediments of the Coastal Plain. The Fall Line is located approximately three miles (5 kilometers) northwest of the site.

In general, the Coastal Plain Province consists of an eastward-thickening wedge of unconsolidated gravels, sands, silts, and clays that have been deposited upon an eroded crystalline basement rock surface that slopes downward towards the east. Many depositional environments existed during the formation of the Coastal Plain. Glacially influenced marine transgressions and regressions, periods of erosion and deposition, fluvial (riverine) processes, and structural deformations have all played a part in the evolution of the Coastal Plain. As a result of these varying processes, the presence, thickness, and lateral continuity of geologic formations are highly variable.

Three primary geologic units were identified during this investigation, in addition to fill materials encountered at the site. The uppermost geologic unit over the majority of the site is comprised of Quaternary age river terrace deposits of interbedded gravel, sand, silt, and clay. The exception to this are the alluvial sediments that were encountered in the southeast corner of the site. Both the river terrace and alluvial deposits were found to unconformably overlie the denser interbedded Cretaceous sands and clays of the Potomac Group. A general description of each stratum, from the ground surface downward, are as follows:

- Fill (Stratum F)- Development of the SEFC has resulted in significant excavation, dumping, construction and demolition, and significant filling to create the present surface. Fill is generally composed of inorganic sands, silts, and clays obtained from nearby materials. The fill encountered at the SEFC often includes construction and demolition debris, particularly within former building footprints. Fill also has been placed in the former canal located between Canal Street and 2nd Street, in areas of former and current utilities, and within former in-ground structures. Fill thickness ranges up to approximately 20 feet (6 meters), and appears thickest in the south and east portions of the site where the land surface has been extended into previous channels of the Anacostia River.

  Prior to 1800, approximately one-third of the site (eastern and southeastern portion of the site extending to the Navy Yard and the Anacostia River) was covered by a shallow embayment of the Anacostia River. The original embayment extended from the current District of Columbia Pumping Station west of the SEFC seawall to M Street near 5th and 6th Streets, S.E. This land was inundated in the 18th century, and later filled in during the 19th and 20th centuries. Soils in this area are typically loose fill extending 15 to 25 feet (5 to 8 meters) deep, and will not bear structures on shallow foundations.

- Alluvial Clay (Stratum AC)- Alluvial clays are generally very soft to medium stiff, dark gray, olive-gray, and brown-gray with organic material. The clays are found in the eastern and southern portions of the site in areas once occupied by the Anacostia River. Alluvial deposits are found below stratum F to depths of approximately 55 feet (17 meters) (-45 feet [14 meters], MSL). The maximum thickness of the alluvial clay is approximately 40 feet (12 meters) in the southeast portion of the site.

- Alluvial Sands (Stratum AS)- Alluvial sands are generally very loose, gray, silty fine to medium sands, often with gravel at the base of the strata. Alluvial sands are found in several areas below stratum AC. The sands, with thicknesses up to eight feet, were found at depths of 55 to 60 feet (17 to 18 meters) (-50 feet [15 meters], MSL).

- Terrace Clays (Stratum TC)- Terrace clays are generally soft to very stiff, red-brown or gray-brown, clays and silts. The terrace clays were found over a large portion of the site, to the northwest of the alluvial deposits, and were sometimes interbedded with terrace sands (Stratum TS). The terrace clays range in thickness from less than one foot to nearly 20 feet (.3 meters to nearly 6 meters).

- Terrace Sands (Stratum TS)- Terrace sands are generally loose to very dense, red-brown to gray-brown, fine to coarse sands with very little silt. The terrace sands were found over a large portion of the site, to the northwest of the alluvial deposits, and were sometimes interbedded with the terrace clays. The sands range in thickness from approximately seven feet (two meters) in the western portion of the site to nearly 45 feet (14 meters) towards the southeast where the terrace deposits meet the alluvium. The terrace sands appear to be more predominant than the terrace clays and are generally the stratum that unconformably overlies the Potomac Group sediments.

- Potomac Clays (Stratum PC)- Potomac clays are generally very stiff to hard, red-brown to gray-brown clays with occasional pockets of sand. The Potomac clays are often interbedded with the Potomac sands, and are more extensive than the sands in the western portions of the site. The clays range in thickness from less than one foot to slightly over 25 feet (less than .3 meters to slighty over 7.6 meters).

- Potomac Sands (Stratum PS)- Potomac sands are generally dense to very dense, gray, greenish-gray and brownish-gray, fine to medium sand with a few zones of fine to coarse sand. The Potomac sands are often interbedded with stratum PC and appear to be more extensive than the clays in the eastern portion of the site. The sands range in thickness from less than one foot to greater than 50 feet (less than .3 meters to 15 meters).

7.1.2 Hydrogeology

The Atlantic Coastal Plain hydrogeology is characterized by numerous water-bearing zones (aquifers), consisting primarily of sands and gravels, separated by less permeable zones of silts and clays (aquitards). The aquifers can occur under both unconfined (water table) and confined (artesian) conditions, depending on the presence and thickness of low permeability confining units. In general, the regional groundwater flow is in an easterly direction, following the dip of the underlying bedrock.

A total of eight monitoring wells (MW01 through MW08) were installed by K&D during the Phase II ESA investigation. Six of these wells, ranging in depth from 12 to 25 feet (3.7 to 7.6 meters), were installed in the uppermost water-bearing zone to assess if chemicals present in the fill material had impacted this water-bearing zone. One of the eight wells, MW03, was installed in the upper sand aquifer (at a depth of 28 feet [8.5 meters]) to monitor the groundwater quality of this formation. Another well, MW05, was installed in the lower sand aquifer (depth of 110 feet [33.5 meters]) to assess the possible impact to groundwater from the shrinkage pit operations and closure.

Thirteen additional monitoring wells (MW-9 through MW-21) were installed at the site as part of this Phase II ESA Update investigation. Nine of these wells (MW-9 through MW-12, MW-15 through MW-18, and MW-20) were deep wells screened in the Potomac group sands to depths of approximately 80 feet (24 meters). The remaining wells (MW-13, MW-14, MW-19, and MW-21) were shallow wells installed to depths of 15 to 30 feet (4.5 to 9 meters) in the water table aquifer. Deep and shallow wells were installed as pairs at three locations (MW-9 and MW-21, MW-10 and MW-13, and MW-15 and MW-14) to investigate the relationship between the two water bearing zones.

The hydrogeology in the vicinity of the site is characterized by the sandy units of the river terrace and Potomac group deposits. These sandy units are generally separated by the Potomac group silts and clays over the majority of the site resulting in two aquifers. This is evidenced at well pairs MW-10/MW-13 and MW-9/MW-21 where water levels in the deeper wells were approximately 1.5 to 2 feet (.45 to .6 meters) higher than their corresponding shallow wells. Two aquifers were also identified in the southeast portion of the site, where shallow groundwater appears to be present in sandy fill materials and separated from the deeper aquifer by alluvial clays. In this area the water level from deep well MW-15 was approximately three feet (one meter) below that of paired well MW-14.

Depths to groundwater in the majority of the monitoring wells (both deep and shallow) place the groundwater at elevations one to five feet (.3 to 1.5 meters) below mean sea level. Only two of the shallow monitoring wells (MW-15 and MW-19) had water levels above mean sea level. Previous experience in the Washington D.C. area has shown groundwater frequently to be located below sea level and is generally associated with activities such as construction dewatering, the location of Metro tunnels, or deep utilities.

Artificially low groundwater conditions at the site may be caused by a combination of one or more of the following factors:

- The majority of the site, and much of the surrounding area, is paved or covered with structures thereby limiting recharge to the shallow groundwater aquifer.

- Two particularly large sanitary/stormwater utility trenches are present along former 2nd Street and Canal Street in the western portion of the site and one large pile-supported utility channel extends across the east side of the site. These utility trenches would primarily affect shallow water in their immediate vicinity.

- Two Metro tunnels cross the site in a northwest to southeast direction. The tunnels extend from a station near the northwest corner of the site to an access shaft located in the southeast portion of the site. The tunnels then continue beneath the Anacostia River. Invert elevations of these structures range from approximately 45-90 feet (14-27 meters) below sea level which is approximately the same elevation at which the deep monitoring wells are screened.

7.2 EVALUATION OF SOILS

Exceedences of applicable action levels were examined on a block-by-block basis in order to develop quantity and cost estimates for remediation of the contaminated soils at the SEFC site. A decision tree was used to determine whether special handling and disposal of excavated soils may be required, and if so, what disposal alternatives are feasible. The initial factor examined was whether exceedences of risk-based residential action levels were found in a particular block (concentrations indicating acceptable concentrations for soils that would be excavated and used as general fill). If no exceedences of risk-based Tier I regulatory action levels occurred, the excavated soils are presumed to be suitable for use as general fill, and no special handling or disposal is necessary. If residential Tier I action level or regulatory action level exceedences were identified, the type of contaminant(s), their concentrations and location were evaluated (Tier II evaluation), and the detected concentrations were compared to commercial/industrial action levels (acceptable concentrations for soils that would remain in place or be used as industrial fill). This second evaluation provided information on the severity of the contamination and the potential disposal options. If a combination of contaminants was found, the most stringent disposal criteria was applied. Although no specific testing for hazardous waste characterization (i.e., Toxicity Characteristic Leaching Procedure (TCLP)), was performed, it is believed that the concentrations of contaminants found in the soils at the site are unlikely to result in significant quantities of soils classifying as hazardous waste.

Tables 7-1, 7-2, and 7-3 identify the chemicals detected in soil during the APEX, K&D, and W-C sampling events, respectively. The frequency with which each chemical was detected and the maximum detected concentration is also shown. The maximum detected chemical concentration was compared with its residential Tier I action level, and the location and concentration of all exceedences are listed. Table 7-4 summarizes all exceedences of residential Tier I action levels for all three sampling events. Seventeen chemicals or parameters were detected in site soils at concentrations that exceeded residential Tier I action levels: one volatile organic compound (trichloroethene or TCE); six semi-volatile organic compounds (benzo(a)pyrene, bis(2-chloroisopropyl ether, 3,3'-dichlorobenzidine, nitrobenzene, phenanthrene, and PCBs; nine metals (arsenic, barium, cadmium, copper, iron, lead, mercury, nickel, and selenium); and TPH.

The disposal alternatives currently available in the Washington Metropolitan area vary with the nature of the contaminant and its concentration. The off-site alternatives for petroleum contaminated soils include thermal desorption, recycling by blending with asphalt paving materials or roadway subbase material, bioremediation, landfilling, and incorporation/recycling of the soils into bricks. PCB-containing soils above 500 mg/kg require disposal at a TSCA approved facility. Disposal options for metals and semi-volatile organic compounds depend upon both the contaminant and the concentration. If the concentrations do not exceed the action levels for industrial/commercial soils, use of these materials as fill at an industrial or commercial site or disposal in a sanitary landfill are viable alternatives. However, it may be difficult to locate facilities willing to accept these soils at little or no cost. Therefore, it has been assumed at this stage of the project that these materials will be disposed in a manner similar to the petroleum contaminated soils, since they are unlikely to fail a hazardous waste characterization test. Soils with concentrations exceeding the commercial/industrial action levels have been assumed to represent hazardous waste, which requires disposal at a RCRA TSD facility. The nearest such facility is located in North Carolina.

Several areas where exceedences occurred exist between block areas, usually under roadways. These areas were evaluated with the nearest adjacent block area. Based on the disposal requirements, several areas of soil requiring removal overlap, and their volumes were determined based on the disposal requirement that would take precedence.

The exceedences of residential and/or commercial/industrial action levels by block area are presented in Table 7-5. Soils contained in three of the 14 excavation blocks did not contain any chemicals in excess of the residential Tier I action levels. These were Blocks B, C, and D. Excavated soils from these blocks are judged to be acceptable for use as general fill. However, a large plume of petroleum hydrocarbon was found in the shallow groundwater within Blocks B, C and F. If this groundwater contamination is not remediated before construction excavation begins on these blocks, the potential exists to contaminate soils with petroleum components as construction dewatering lowers the groundwater.

BLOCK A

One detection of PCBs (K&D B2) at a concentration that exceeded the residential Tier I action level was noted near Block A (at K&D B2). This detection was evaluated against the Tier II criteria specified in Section 6. The frequency of PCB exceedence in Block A is low. The detected concentration (2,500 μg/kg) was 2.5 times the action level, indicating the exceedence is of moderate magnitude. The PCB concentration did not exceed the commercial/industrial action level. Based on these factors, it is recommended that the area around sample location K&D B2 be excavated and handled separately from general fill soils. The area to be removed is shown on Figure 7-5 (enlarged area from Plate 1).

<u>AREA: A1</u>

Constituents of Concern: PCBs

Action Level: 1,000 μg/kg (excavated soils)
10,000 μg/kg (remaining soils)

RBC for 1254: ~~140~~ 140 ~~mg~~ ug/Kg

Exceedence Location: K&D B2 (2,500 μg/kg) -

Depth of Excavation: 0 to 4 feet (0- 1 meter)

- K&D B2 was located beneath Building 216 and was in a proposed roadway area outside of Block A. No samples were analyzed below 3.5 feet (1 meter) at this location.

- Construction of the roadway was assumed to require excavation and grading up to a depth of 4 feet (1 meter). Since PCBs are relatively immobile in soil, soils below the 4-foot (1-meter) depth were assumed to ? have PCB concentrations below the commercial/industrial action level for remaining soils and will therefore not require removal.

Lateral Extent: A 15-foot (4.5 meter) square area centered around the sump pit in Building 216

- Boring K&D B2 was located approximately three feet (one meter) south of an existing sump pit within Building 216. This pit reportedly held waste oil and hydraulic fluid and may be a possible source of the PCBs.

- K&D reports the capacity of the sump pit to be approximately 275 gallons (1040 liters). This capacity corresponds to a typical tank size of approximately 3 feet x 5 feet x 3 feet (1 meter x 2 meters x 1 meter). Since the actual size and orientation of the sump pit is unknown, the pit is assumed to be a 5-foot (1.5 meter) square.

- In addition to K&D B2, PCBs were also detected at SB112 (64 140 μg/kg), located approximately 35 feet (11 meters) west of K&D B2. Since the detection at this location is below the residential action level for excavated soils, removal of soil that extends to this location is unnecessary.

- Since PCBs are relatively immobile in soil, and the sump pit is considered a possible source, it is assumed that soil requiring removal extends 5 feet (1.5 meters) beyond each edge of the sump pit.

Disposal Method: Disposal or use as commercial/industrial fill. ?

Prob. ok

BLOCK E

RBC 39,000 ug

Block E contained one detection of nitrobenzene at a concentration (182 μg/kg) that exceeded the residential Tier I action level of 90 μg/kg. It was the sole detection of nitrobenzene across the site, so it has a low frequency of occurrence. The detected concentration (182 μg/kg) was two times the residential action level (90 μg/kg), indicating the exceedence was of low magnitude. Nitrobenzene was not detected in any groundwater or Hydropunch™ sample. Based on these factors, the residential action level exceedence in Block E is judged not to be significant, and soil from Block E is judged to be acceptable for use as general fill.

BLOCK F

One detection of TPH (SB22) at a concentration that exceeded both DCERA's excavation action level and in-place action level was identified near Block F (at SB-022). This detection was evaluated against Tier II criteria. This detection was the only TPH analysis of soils in Block F, so the true frequency of exceedence is unknown. The detected concentration (2,100 mg/kg) was 210 times the residential action level and 21 times the in-place action level, indicating the exceedence is of high magnitude. Based on these factors, it is recommended that the area around sample location SB22 be excavated and handled separately from general fill soils. The area to be removed is shown on Figure 7-6 (enlarged area from Plate 1).

AREA: F1

Constituents of Concern: TPH

Action Level: 10 mg/kg (excavated soils)
100 mg/kg (remaining soils)

Exceedence Location: SB22 (2,100 mg/kg)

Depth of Excavation: 0 to 5.3 feet (0 to 2 meters)

shallow

- The TPH exceedence was noted at a depth interval of 0.5 to 4.3 feet (.2 to 1.3 meters). This sample was located in a proposed roadway area outside of Block F. No samples were analyzed below 4.3 feet (1.3 meters) at this location.

- Construction of the roadway was assumed to require excavation and grading up to a depth of 4 feet (1.2 meters). Since the sample interval at SB22 extends below this 4-foot (1.2 meters) depth, soils requiring removal are assumed to extend 1-foot (.3 meter) below the sample interval.

Lateral Extent: A rectangle 20 feet x 60 feet (6 meters x 18 meters) centered around SB22.

Assume. For estimates only

Don't know how you can estimate. The lateral extent

- The soil sample from SB22 was initially not scheduled for TPH analysis. This analysis was added due to reports of high organic vapor readings encountered by the archaeological contractor during excavation. Since this area was not being investigated for TPH, no additional TPH data exists in the vicinity of SB22 that can be used to delineate the lateral extent.

- Review of historical information indicated that a railroad spur, oriented in a north-south direction, was located very near Boring SB22. Activities associated with the spur, such as maintenance and loading or unloading operations, may be a possible source of the TPH.

- Assuming that a spill associated with railroad activities would most likely be localized along the track, and that the tracks were 10 feet (3 meters) wide, it is estimated that soil requiring removal would extend 5 feet (1.5 meters) beyond each edge of the track in an east-west direction, and 30 feet (9 meters) to either side of SB22 in a north-south direction.

Disposal Method: Dispose as petroleum contaminated soil.

Removal
16 MG/KG
16,000

BLOCK G

Two chemicals at concentrations that exceeded the residential Tier I action levels were noted within or near Block G:

140

- PCBs: 5,000 μg/kg at K&D25 exceeding the action level of 1,000 μg/kg

- TPH: (two exceedences of the action level of 10 mg/kg)
  219 mg/kg at A6s
  2,090 mg/kg at A6d

The exceedences were evaluated against Tier II criteria. These detections were the only PCB and TPH analyses of soils in Block G, so the true frequency of exceedence is unknown. The detected concentrations of PCBs and TPH were 5 to 200 times the residential action levels, indicating the exceedences were of high magnitude. The concentration of PCBs does not exceed the commercial/industrial action level, while the concentrations of TPH exceed the DCERA's in-place action level. Based on these factors, it is recommended that the area around sample locations K&D25 and A6 be excavated and handled separately from general fill soils. The areas to be removed are shown on Figure 7-7 (enlarged area from Plate 1).

AREA: G1

Constituents of Concern: PCBs

Action Level: 1,000 μg/kg (excavated soils)
10,000 μg/kg (remaining soils)

Exceedence Location: K&D25 (5,000 μg/kg)

Depth of Excavation: 0 to 4 feet (0 to 1.2 meters)

- The PCB action level exceedence was noted at a depth interval of 1 to 3 feet (.3 to 1 meter). Results at K&D25 from a depth interval of 9 to 13 feet (3 to 4 meters) were below the sample detection limit (not reported by K&D) for PCBs. These samples are located in a proposed roadway area near the edge of Block G.

- Construction of the roadway was assumed to require excavation and grading up to a depth of 4 feet (1.2 meters), and general excavation of Block G will most likely extend to a depth of up to 30 feet (9 meters). Since PCBs are relatively immobile in soil, soils requiring removal are assumed to extend 1-foot (.3 meter) below the sample interval where the exceedence occurred.

Lateral Extent: A circle with a radius of 30 feet (9 meters) around K&D25.

- No other soil samples were analyzed for PCBs in the vicinity of K&D25 that could be used to delineate the lateral extent. In addition, no likely sources of PCBs could be identified at this location. Therefore, it is assumed that soil requiring removal extends 30 feet (9 meters) from K&D25 in all directions.

Disposal Method: Disposal or use as commercial/industrial fill.

AREA: G2

Constituents of Concern: TPH

Action Level: 10 mg/kg (excavated soils)
100 mg/kg (remaining soils)

Exceedence Location: A6s (219 mg/kg)
A6d (2,090 mg/kg)

Depth of Excavation: Ground surface to water table (approximately 18 feet (5.5 meters))

- Two exceedences of the TPH action level at depth intervals of 2.5 to 11 feet (.76 to 3.4) and 12 to 15 feet (3.7 to 4.6 meters). These samples are located within the northern portion of Block G.

- Excavation in the northern portion of Block G will most likely extend to a depth of 30 feet (9 meters). Data obtained from monitoring wells and hydropunch™ samples indicate that the water table is located at a depth of approximately 18 feet (5.5 meters) in the vicinity of Block G. Since the TPH concentration in the deeper sample interval is well above the action level for soils that can remain-in-place, and it is typical for TPH to concentrate at the water table, soils requiring removal are assumed to extend to the water table (approximately 18 feet (5.5 meters)).

Lateral Extent: A circle with a radius of 30 feet (9 meters) around Boring A6 (less the volume removed from Area G1).

Lateral extent estimation seems to be a guess

- No other soil samples were analyzed for TPH in the vicinity of Boring A6. In addition, no likely sources could be identified for TPH at this location. Therefore, it is assumed that soil requiring removal extends 30 feet (9 meters) from Boring A6 in all directions.

- It should be noted that soils requiring removal in Areas G1 and G2 overlap. The volume of soil from Area G1 that extends into Area G2 is subtracted from the entire volume of Area G2 for the volume calculations.

Disposal Method: Disposal as petroleum contaminated soil.

BLOCK H

Block H contained three chemicals or parameters at multiple locations where concentrations exceeded the residential Tier I action levels:

- Nickel (two exceedences of the action level of 100 mg/kg):

  369 mg/kg at A-7d
  157 mg/kg at K&D29A

  1600 mg RBC

- Lead (three exceedences of the action level of 400 mg/kg):

  681 mg/kg at K&D29A
  4,100 mg/kg at SB35
  932 mg/kg at SB36

  commercial fill?

- TPH (13 exceedences of the action level of 10 mg/kg):

45 mg/kg at T-7-02	840 mg/kg at SB8
890 mg/kg at P-14-02	1,600 mg/kg at SB9
160 mg/kg at P-14-03	11,000 mg/kg at SB11
620 mg/kg at P-17-03	3,200 mg/kg at SB13
1,500 mg/kg at P-17-09	7,000 mg/kg at SB16
1,200 mg/kg at P-17-10	79 mg/kg at SB15
490 mg/kg at SB6	

These exceedences were evaluated against Tier II criteria. A high frequency of exceedences has occurred. The magnitude of the exceedences is also high, ranging from 1.5 to over 1,000 times the residential action levels. The soil exceedences are scattered throughout Block H, although some are clustered in close proximity. No monitoring wells are located on this block, so it is unknown whether groundwater has been impacted. However, nickel was detected at MW-15 (located downgradient on Block O) at a concentration greater than its groundwater action level (see Section 6.0). Based on these factors, the residential action level exceedences in Block H are judged to be significant, making these soils unsuitable for use as general fill. The concentrations of nickel and lead are below the commercial/industrial action levels, but, with one exception, the concentrations of TPH all exceed the in-place action level. It is recommended that these impacted soils from Block H be excavated and handled separately from general fill soils. The areas to be removed are shown on Figure 7-8 (enlarged area from Plate 1).

AREA: H1

Constituents of Concern: Lead (Pb), Nickel (Ni)

Action Level(s): Pb - 400 mg/kg (excavated soils); 5,000 mg/kg (remaining soils)
Ni - 100 mg/kg (excavated soils); 40,880 mg/kg (remaining soils)

Exceedence Locations: K&D29, SB35, SB36

Depth of Excavation: 0 - 5.5 feet (0 -1.7 meters)

- Exceedences of the Pb residential action level were noted at a depth interval of 0.5-4.5 feet (.1-1.4 meters) at K&D29 (681 mg/kg), SB35 (4,100 mg/kg) and SB36 (932 mg/kg), but concentrations were below the commercial/industrial action level. One exceedence of the Ni residential action level was also noted at K&D29 (157 mg/kg) at a depth of 0.5-2.5 feet (.1-.76 meters), but the commercial/industrial action level was not exceeded. Detections of Pb and Ni at K&D29 in deeper sample (from 4.5-6.5 feet), were below the action levels for both excavated and remaining soils. These samples are located near the center of Block H.

- Excavation of Block H will most likely extend to a depth of up to 30 feet (9 meters). Since metals are relatively immobile in soil, soils requiring removal are assumed to extend 1-foot (.3 meter) below the deepest sample interval where the exceedences occurred.

Lateral Extent: A circle with a radius of 30 feet (9 meters) centered around exceedence locations.

WHOT - level

- Detections of Pb were also noted below action levels at Borings SB34 and SB37 located to the north and west of K&D29, respectively. These borings are approximately 35 feet (11 meters) from the center of a circle surrounding the exceedence locations, indicating that removal of soil that extends to this location is unnecessary.

- Block H was reportedly used for storage of scrap metal, which may be a possible source for the Pb and Ni. Since metals are relatively immobile in soil, and Borings SB34 and SB37 had concentrations below the action levels, it is assumed that soil requiring removal is located within a circle (30-foot (9 meter) radius)) centered around the three exceedence locations.

Disposal Method: Since all exceedences are below the commercial/industrial action levels, the soils are presumed non-hazardous and may be disposed as commercial/industrial fill, or in conjunction with the TPH contaminated soils in the remainder of the Block.

AREA: H2

Constituents of Concern: TPH

Action Level(s): 10 mg/kg (excavated soils)
100 mg/kg (remaining soils)

Exceedence Locations: T7-02, P14-02, P14-03, P17-03, P17-09, P17-10, SB6, SB8, SB9, SB11, SB13, SB16

Depth of Excavation: Ground surface to the water table (approximately 20 feet (6 meters))

- Exceedences of the action levels for both excavated and remaining soils were noted at various depth intervals throughout the block. The depth interval of 18-20 feet (5.5-6 meters) was the deepest interval investigated and believed to be the approximate location of the groundwater table.

- Excavation of Block H will most likely extend to a depth of up to 30 feet (9 meters). Since concentrations exceeding the action level are scattered at various depths, and it is typical for TPH to concentrate at the water table, it is assumed that soils requiring removal extend from the ground surface to the water table.

Lateral Extent of Excavation: Entire footprint of Block H (200 foot x 420 foot (61 meter x 128 meter rectangle)) <u>minus</u> the volume of <u>Area H1</u>.

- Review of historical information indicates that two underground storage tanks were located in Block H, and that oil reclamation activities were also conducted within the block. These activities may be a possible source of extensive TPH in Block H.

- In addition to the exceedences, TPH field-screening results also suggest scattered exceedences at various depths and locations throughout the block. Detection limits of both the laboratory and field-screening analyses were slightly above the action level for excavated soils, indicating that a non-detect could possibly represent an exceedence of the DCERA action level.

- Since TPH exceedences were scattered throughout Block H both laterally and vertically, and activities or tanks throughout the block could be possible sources, it is assumed that soil requiring removal will extend to the limits of the block on all four sides.

- It should be noted that the soils requiring removal in Area H1 are completely within Area H2. The volume of soil from Area H1 is subtracted from the entire volume of Area H2 for volume calculations.

Disposal Method: Dispose as petroleum contaminated soil.

<u>**AREA: H3**</u>

Constituents of Concern: TPH

Action Level(s): 10 mg/kg (excavated soils)
100 mg/kg (remaining soils)

Exceedence Location: SB15 (79 mg/kg)

Depth of Excavation: 0-4 feet (0-1.2 meters)

- Construction of the roadway was assumed to require excavation and grading up to a depth of 4 feet (1.2 meters). Field-screening results at a depth interval of 1 to 3 feet (.3 to 1 meters) (SB15) indicate that TPH concentrations may exceed the action level for excavated soils. The detection of TPH at SB15 was at a depth (8 to 10 feet (2 to 3 meters)) below this anticipated excavation and does not exceed the action level for remaining soils. Therefore, it is assumed that soils requiring removal extend to a depth of 4 feet (1.2 meters).

Lateral Extent of Excavation: A rectangle 40 feet x 60 feet (12 x 18 meters)

- Boring SB15 is located approximately 45 feet (14 meters) block H. Since widespread TPH contamination was found within Block H, and past activities within the block may have been a possible source of the TPH, these activities may be contributing to the TPH identified at SB15.

- Since the TPH contamination is most likely associated with Block H, it is estimated that soil requiring removal extends 20 feet (6 meters) on either side of SB15 in an east-west direction, and from the north edge of Block H to the north property boundary.

Disposal Method: Dispose as petroleum contaminated soil.

BLOCK J

Block J contained eight chemicals or parameters, at multiple locations, at concentrations that exceeded the residential Tier I action levels:

- Arsenic: 45.4 mg/kg at SB41 exceeding the action level of 40 mg/kg 15

- Copper: 71,900 mg/kg at A-8d exceeding the action level of 5,475 mg/kg - ORDER OF MAGNITUDE HIGHER THAN RBC

- Iron: (one exceedence of the action level of 54,750 mg/kg)
  69,200 mg/kg at K&D40B

- Lead (two exceedences of the action level of 400 mg/kg)
  505 mg/kg at A-8s
  430 mg/kg at K&D36B

- Nickel (two exceedences of the action level of 100 mg/kg)
  215 mg/kg at K&D35A
  216 mg/kg at K&D40A

- Selenium (two exceedences of the action level of 3 mg/kg)
  3.2 mg/kg at K&D36A
  9.7 mg/kg at K&D36B

- PCB (two exceedences of the action level of 1,000 μg/kg)
  1,500 μg/kg at K&D35A
  3,400 μg/kg at K&D40A RBC- 83

- Benzo(a)pyrene (B(a)P) (one exceedence of the action level of 9,000 μg/kg)
  19,000 μg/kg at SB-50 88 μg/kg RBC

All of the above detected concentrations are below commercial/industrial action levels.

Boring K&D36 is located approximately 15 feet (4.6 meters) south of Building 202. This building is currently planned for renovation and will not be removed during construction. Since soils in the vicinity of K&D36 will not be excavated, and detections of Pb and Se at this location are below the commercial/industrial action levels, detections at K&D36 are judged to be insignificant and no action is recommended at this location.

The remaining exceedences were found at four separate locations throughout Block J and were evaluated against Tier II criteria. A high frequency of exceedences has occurred. The magnitude of the exceedences is moderate, ranging from 1.1 to over 13 times the residential action levels. None of these chemicals were detected at concentrations above groundwater action levels in MW-07, the monitoring well located on this block. Based on these factors, the residential action level exceedences in Block J are judged to be significant, making these soils unsuitable for use as general fill. It is recommended that soils from Block J be excavated and handled separately from general fill soils. The areas to be removed are shown on Figure 7-9 (enlarged area from Plate 1).

AREA: J1

Constituents of Concern: PCBs, Nickel (Ni)

Action Level: PCBs- 1,000 μg/kg (excavated soils), 10,000 μg/kg (remaining soils)
Ni- 100 mg/kg (excavated soils), 40,800 mg/kg (remaining soils)

Exceedence Location: K&D40

Depth of Excavation: 0 to 3.5 feet (0 to 1 meter)

- One exceedence of the PCB residential action level was noted at a depth interval of 1.5 to 2.5 feet (.45 to .79 meters) at K&D40 (3,400 μg/kg). In addition, one exceedence of the Ni residential action level was noted at the same depth interval at K&D40 (216 mg/kg). Results at K&D40 for PCBs and Ni from a depth interval of 9 to 11 feet (2.7 to 3.3 meters) were below the residential action levels. These samples are located in the northeastern portion of Block J.

- Excavation of portions of Block J will most likely extend to a depth of up to 30 feet (9 meters). Since PCBs and metals are relatively immobile in soil, soils requiring removal are assumed to extend 1-foot (.3 meter) below the sample interval where the exceedence occurred.

Lateral Extent: A rectangle 30 feet x 60 feet (9 meters x 18 meters) centered around K&D40.

- Boring K&D40 is located approximately 30 feet (9 meters) south of an existing PEPCO sub-station and near the location of a former railroad track. Information concerning the past use of PCB containing equipment at this location is uncertain, however, the sub-station and activities along the railroad may be possible sources of the PCBs and Ni. No additional samples were analyzed for PCBs and Ni in the vicinity of K&D40.

- Since PCBs and metals are relatively immobile in soil, and the sub-station and railroad track are considered possible sources, it is assumed that soil requiring removal would extend 30 feet (9 meters) south from the edge of Block J, and 30 feet (9 meters) on either side of K&D40 in an east-west direction.

Disposal Method: Dispose as commercial/industrial fill, or landfill.

AREA: J2

Constituents of Concern: PCBs, Nickel (Ni)

Action Level: PCBs- 1,000 μg/kg (excavated soils), 10,000 μg/kg (remaining soils)
Ni- 100 mg/kg (excavated soils), 40,800 mg/kg (remaining soils)

Exceedence Location: K&D35

Depth of Excavation: 0 to 5.5 feet (0 to 1.7 meters)

- One exceedence of the PCB residential action level was noted at a depth interval of 2.5 to 4.5 feet (.76 to 1.4 meters) at K&D35 (1,500 μg/kg). In addition, one exceedence of the Ni residential action level was noted at the same depth interval at K&D40 (216 mg/kg). Neither exceedence was above the commercial/industrial action level.Results at K&D35 from a deeper depth interval of 10.5 to 12.5 feet (3.2 to 3.8 meters) were below the residential action levels for excavated soils for both PCBs and Ni. These samples are located near the center of Block J between Buildings 74 and 202.

- Excavation of portions of Block J will most likely extend to a depth of up to 30 feet. Since PCBs and metals are relatively immobile in soil, soils requiring removal are assumed to extend 1-foot (.3 meter) below the sample interval where the exceedence occurred.

Lateral Extent: A circle with a radius of 30 feet (around K&D35.

- No other soil samples were analyzed for PCBs or Ni at comparable depth intervals in the vicinity of K&D35. Results of PCB and Ni analyses from Boring K&D B20 (60 feet (18 meters southwest)), were below the PCB and Ni residential action levels and removal of soils that extend to these locations appears unnecessary. Since no likely sources could be identified for the PCBs and Ni at this location, it is assumed that soil requiring removal extends 30 feet (9 meters) from K&D35 in all directions.

Disposal Method: Dispose as commercial/industrial fill, or landfill.

Seems Hill Level of PCBs for Landfill

AREA: J3

Constituents of Concern: Arsenic (As)

Action Level: 40 mg/kg (excavated soils), 382 mg/kg (remaining soils)

Exceedence Location: SB41 (45.4 mg/kg)

Depth of Excavation: 0 to 6 feet (0 to 2 meters)

- One exceedence of the As residential action level was noted at a depth interval of 1 to 5 feet (.3 to 1.5 meters) at Boring SB41. This concentration is below the commercial/industrial action level. No samples were analyzed below a depth of 5 feet (1.5 meters) at this location, however As results at K&D41, located 20 feet (6 meters) east of SB41, were below the residential action level at a depth interval of 6 to 10 feet (2 to 3 meters). These samples are located to the east of Building 74 and near the center of Block J.

- Excavation of portions of Block J will most likely extend to a depth of up to 30 feet (9 meters). As concentrations in the upper 5 feet (1.5 meters) exceed the residential action level for excavated soils. Since metals are relatively immobile in soil, soils requiring removal are assumed to extend 1-foot (.3 meter) below the sample interval where the exceedence occurred.

Lateral Extent: A 35-foot (11 meter) square area centered around SB41.

- Detections of As were also noted at Borings K&D41 and SB40 (to the east and southeast of SB41, respectively) at concentrations below the As residential action level. Therefore, removal of soils that extend to these locations appear unnecessary.

- Since no likely source for As could be identified, the eastern and southern extents of soil requiring removal were established near these surrounding borings where concentrations were below action levels. The northern boundary is assumed to be the same distance as the distance from SB41 to the southern boundary (i.e., symmetrical) and the western boundary is assumed to extend to Building 74, which will not be removed during construction.

Disposal Method: These soils may be disposed as commercial/industrial fill, or landfill.

AREA: J4

Constituents of Concern: Lead (Pb), Copper (Cu)

Action Level: Pb- 400 mg/kg (excavated soils), 5,000 mg/kg (remaining soils)

Cu- 5,475 mg/kg (excavated soils), 143,080 mg/kg (remaining soils)

Exceedence Location: A8

Depth of Excavation: 0 to 16 feet (0 to 4.9 meters)

- One exceedence of the Pb residential action level was noted at a depth interval of 3 to 10 feet (1 to 3 meters) at Boring A8 (505 mg/kg). One exceedence of the Cu residential action level was noted at a depth interval of 11 to 15 feet (3.4 to 4.5 meters) at Boring A8 (71,900 mg/kg). Both concentrations were below commercial/industrial action levels. No samples were analyzed below a depth of 15 feet (4.5 meters) at this location. These samples are located between Buildings 202 and 74 in the southern portion of Block J.

- Excavation of portions of Block J will most likely extend to a depth of up to 30 feet (9 meters). Since metals are relatively immobile in soil, soils requiring removal are assumed to extend 1-foot (.3 meter) below the deepest sample interval where an exceedence occurred.

Lateral Extent: A 35-foot (11 meter) square area centered around Boring A8.

- Detections of Pb were also noted at Borings SB42, SB43, SB44, and SB45 to the north, east, south, and west of Boring A8, respectively, at concentrations below the Pb residential action level. Therefore, removal of soils that extend to these locations appears unnecessary. No additional samples in the vicinity of Boring A8 were analyzed for Cu.

- Since no likely source for these metals could be identified, the extents of soil requiring removal were established near these surrounding borings where concentrations were below the Pb action levels.

Disposal Method: Disposal as industrial/commercial fill, or landfill.

BLOCK K

Block K contained two chemicals at concentrations that exceeded the residential Tier I action levels:

- Barium: 402 mg/kg at K&D04A exceeding the action level of 266 mg/kg

- Lead: (one exceedence of the action level of 400 mg/kg)
  427 mg/kg at K&D04A

These exceedences were evaluated against Tier II criteria. With three exceedences, a moderate frequency of exceedence has occurred. The magnitude of the exceedences is low to moderate at 1.1 to 2.4 times the residential action levels. Neither of these chemicals were detected in groundwater at MW-02, the monitoring well located on this block, suggesting that groundwater impacts may not have occurred. Based on these factors, the action level exceedences in Block K are judged to be marginally significant. It is recommended that the impacted area around sample locations K&D04 be excavated and handled separately from remaining soils as described below. The area to be removed is shown on Figure 7-10 (enlarged area from Plate 1).

<u>AREA: K1</u>

Constituents of Concern:	Lead (Pb), Barium (Ba)
Action Level(s):	Pb - 400 mg/kg (excavated soils), 5,000 mg/kg (remaining soils) Ba - 266 mg/kg (excavated soils), 143,080 mg/kg (remaining soils)
Exceedence Locations:	K&D04
Depth of Excavation:	0-6 feet (0 to 2 meters)

- Exceedences of the Pb residential action level were noted at a depth of 1-5 feet at K&D04 (427 mg/kg). One exceedence of the Ba residential action level was noted at K&D04 (402 mg/kg) at a depth of 1-5 feet (.3 to 1.5 meters). Detected concentrations of both metals were below commercial/industrial action levels. Detections of Pb and Ba at K&D04, from a deeper depth interval of 9-11 feet (2.7 to 3.4 meters), were below residential action levels. Detection of Pb in nearby SB54 at 374 mg/kg was below the residential action level. These samples are located near the center of Block K.

- Excavation of Block K will most likely extend to a depth of 30 feet (9 meters). Since metals are relatively immobile in soil, soils requiring removal are assumed to extend 1-foot (.3 meter) below the sample interval where the exceedences occurred.

Lateral Extent: A square 30 feet x 30 feet (9 meter x 9 meter) centered around K&D04.

- Detections of Pb were also noted at Borings SB51, SB52, SB53 and SB54 to the north, east, south and west of K&D04, respectively, at concentrations below the Pb residential action level. Therefore, removal of soils that extend to these locations appear unnecessary.

- Since no likely sources for these metals could be identified, the northern, eastern, and southern extents of soil requiring removal were established near these surrounding borings where concentrations were below action levels.
- It is assumed that any Ba contamination will be removed along with the Pb.

Disposal Method: These soils may be disposed as commercial/industrial fill, or landfill.

BLOCK L

One chemical at a concentration that exceeded the residential Tier I action levels was noted within Block L:

- Nickel: 305 mg/kg at SB121 exceeding the action level of 100 mg/kg

The exceedence was evaluated against Tier II criteria. Detections at K&D07 and SB121 were the only analyses of soils in Block L, so the true frequency of exceedence is unknown. The detected concentration of Ni (305 mg/kg) was 3 times the residential action level, indicating the exceedence was of moderate magnitude. Based on these factors, it is recommended that the area around sample location SB121 be excavated and handled separately from general fill soils. The area to be removed is shown on Figure 7-11 (enlarged area from Plate 1).

<u>**AREA: L1**</u>

Constituents of Concern: Nickel (Ni)

Action Level: 100 mg/kg (excavated soils), 40,880 (remaining soils)

Exceedence Location: SB121 (305 mg/kg)

Depth of Excavation: 0 to 6 feet (0 to 2 meters)

- One exceedence of the Ni residential action level was noted at a depth interval of 1 to 5 feet (.3 to 1.5 meters) at SB121. This concentration is below the commercial/industrial action level. No samples were analyzed below 5 feet (1.5 meters) at this location. This sample location is located in the southeast corner of Block L.

- Excavation of Block L will most likely extend to a depth of 20 to 30 feet (6 to 9 meters). Since metals are relatively immobile in soil, soils requiring removal are assumed to extend 1-foot (.3 meter) below the sample interval where the exceedences occurred.

Lateral Extent: A circle with a radius of 30 feet (9 meters) around SB121.

- No other soil samples were analyzed for Ni in the vicinity of SB121 that could be used to delineate the lateral extent. In addition, no likely sources of Ni could be identified at this location. Therefore, it is assumed that soil requiring removal extends 30 feet (9 meters) from SB121 in all directions.

Disposal Method: The excavation soil may be disposed as commercial/industrial fill, or landfilled.

BLOCK M

Block M contained two chemicals at concentrations that exceeded the residential Tier I action level:

58,000 µg/kg

- Trichloroethene: 650 µg/kg at Boring A-11 exceeding the action level of 20 µg/kg

- 3,3'-Dichlorobenzidine: 3,500 µg/kg at K&D21A exceeding the action level of 1,000 µg/kg

1,400

The detected concentration of 3,3'-dichlorobenzidine exceeds its commercial/industrial action level; the detected concentration of TCE exceeds only the residential action level.

These exceedences are evaluated against Tier II criteria. The frequency of exceedence is low. The magnitude of the exceedence is high (3.5 to over 30 times the residential action level). Trichloroethene was not detected in groundwater at MW-04, located downgradient of sample location A-11, but the chemical was detected in two other soil samples in the same general area: in SB123 and K&D B10 at concentrations below the residential action level. This suggests a potential localized source. 3,3'-Dichlorobenzidine was not detected in any other soil sample, nor was it detected in the groundwater. Based on these factors, the residential action level exceedence in Block M is judged to be significant. It is recommended that the impacted area be excavated and handled separately from general fill soils. The areas to be removed are shown on Figure 7-12 (enlarged area from Plate 1).

AREA: M1

Constituents of Concern: TCE

Action Level: 20 µg/kg (excavated soils)
522,000 µg/kg (remaining soils)

Removal Guideline

522 MG
9700 -ML Removal
58. MG - RBC

Exceedence Location: A-11 (650 μg/kg)

Depth of Excavation: 0 to 8 feet (0 to 2.5 meters)

- One exceedence of the TCE residential action level was noted at a depth interval of 1 to 7 feet (.3 to 2.2 meters) at Boring A11. This concentration is below the commercial/industrial action level. Results at A11 from a deeper depth interval of 7 to 12.5 feet (2 to 4 meters) were below a detection limit of 100 μg/kg (above the residential action level of 20 μg/kg). These samples are located in the southwest corner of Block M near Building 159.

- TCE concentrations in the upper 7 feet (2.1 meters) exceed the residential action level for excavated soils. Excavation of Block M will most likely extend to a depth of 20 to 30 feet (6 to 9 meters). Since it is possible that concentrations of TCE may be slightly above the action level (but below a detection limit of 100 μg/kg), soils requiring removal are assumed to extend 1-foot (.3 meter) below the 1-7 foot (.3 to 2.1 meter) sample interval where the exceedence occurred.

Lateral Extent: A 40-foot (12 meter) square area centered around Boring A-11

- Boring A-11 was located approximately 25 feet (7.6 meters) south of Building 159. This building reportedly housed a machine shop, tool and sight shop, and a torpedo tube shop. A sump pit was also reportedly located in the southwest corner of the building. Activities associated with the sump pit and building uses may be possible sources of the TCE.

- TCE was also detected at SB123 at a depth interval of 1 to 4 feet (.3 to 1.2 meters), and at K&D B10 at a depth interval of 3 to 7 feet (1 to 2.2 meters), both at concentrations below the residential action level. SB123 is located approximately 65 feet (20 meters) southwest of A11, and K&D B10 is located between A11 and Building 159 (approximately 20 feet (6 meters) north of A11). Removal of soils that extend beyond K&D B10 appears unnecessary. It is assumed that soil requiring removal extends 20 feet (6 meters) beyond A-11 in each direction.

Disposal Method: Given the relatively low concentration of TCE and the expected limited extent, this material can probably be disposed with other petroleum contaminated soils. ?

AREA: M2

Constituents of Concern: 3.3'Dichlorobenzidine

Action Level: 1,000 μg/kg (excavated soils)
1,272 μg/kg (remaining soils)

Exceedence Location: K&D21

Depth of Excavation: 0 to 4 feet (0 to 1.2 meters)

- One exceedence of the 3,3'-dichlorobenzidine residential action level was noted at a depth interval of 0.2 to 2.2 feet 9.1 to .67 meters) at K&D21 (3,500 μg/kg). This concentration is also above the commercial/industrial action level (1,272 μg/kg). This chemical was not detected in any other soil sample or in groundwater.

- Excavation of Block M will most likely extend to a depth of 20 to 30 feet (6 to 9 meters). Since there is no evidence of 3,3'-dichlorobenzidine in any other soil sample, soils requiring removal are assumed to extend 1-foot (.3 meter) below the 0.2-2.2 foot (.1 to .67 meter) sample interval where the exceedence occurred.

Lateral Extent: A 15-foot (4.6 meter) radius circle centered around K&D21

- K&D21 is located in a proposed roadway area adjacent to Block M. The 3,3'-dichlorobenzidine is most likely associated with a rail track bed that once extended north-south to the loading dock at the river. Four borings surrounding K&D21 did not detect 3,3'-dichlorobenzidine and these borings limit the extent.

Disposal Method: Since the concentration exceeded the commercial/industrial action level, disposal in a RCRA TSD facility is assumed to be required.

BLOCK N

Five chemicals at concentrations that exceed the residential Tier I action levels were noted in or near Block N:

- TPH: 327 mg/kg at A9 exceeding the action level of 10 mg/kg

- Barium: 328 mg/kg at SB131 exceeding the action level of 266 mg/kg

- Nickel: (two exceedences of the action level of 100 mg/kg)
  160 mg/kg at A9s
  312 mg/kg at A9d

- Lead: (two exceedences of the action level of 400 mg/kg)
  431 mg/kg at SB126
  2,540 mg/kg at SB131

- Benzo(a)pyrene (one exceedence of the action level of 9,000 μg/kg)
  10,000 μg/kg at SB-76

88 - RBC 14.6 H

Boring SB126 is located at the southern edge of Block N and within approximately 10 feet (3 meters) of Building 173. Since this building is currently planned for renovation and will not be removed during construction, most of the soils surrounding this building will remain in-place. The detection of Pb at SB126 (431 mg/kg) is only slightly above the residential action level (400 mg/kg), and is below the commercial/industrial action level for remaining soils (5,000 mg/kg). Since excavation in this area will be limited due to the close proximity to Building 173, lead at SB126 is judged to be insignificant and no action is recommended at this location.

The remaining exceedences occurred at three locations just outside of Block N (Borings A9, SB76 and SB131), and were evaluated against Tier II criteria. With six exceedences, the frequency of exceedence is moderate to high. The magnitude of the exceedences is low to high, ranging from 1.1 to 33 times the residential action levels. Based on these factors, the action level exceedences at these three locations are judged to be significant. It is recommended that impacted soils in the vicinity of Boring A9, SB76 and SB131 be excavated and handled separately from general fill soils. The areas to be removed are shown on Figure 7-13 (enlarged area from Plate 1).

AREA: N1

Constituents of Concern: TPH, Nickel (Ni)

Action Level: TPH- 10 mg/kg (excavated soils), 100 mg/kg (remaining soils)
Ni- 100 mg/kg (excavated soils), 40,800 mg/kg (remaining soils)

Exceedence Location: A9

Depth of Excavation: 0 to 14 feet (0-4.3 meters)

- Exceedences of the Ni residential action level were noted at Boring A9 from depth intervals of 2-10 feet (.6 to 3 meters) (160 mg/kg) and 10-13 feet (3 to 4 meters) (312 mg/kg). These concentrations are below the commercial/industrial action level. In addition, one exceedence of the TPH action levels for both excavated and remaining soils was noted at a depth interval of 2 to 10 feet (.6 to 3 meters) at Boring A9 (327 mg/kg). No samples were analyzed for TPH below 10 feet (3 meters) at this location. These samples are located along the northern edge of Block N near a proposed roadway area.

- Construction of the roadway was assumed to require excavation and grading up to a depth of 4 feet (1.2 meters), and excavation of approximately the east half of Block N will most likely extend to depths of 20 to 30 feet (6 to 9 meters). Ni and TPH concentrations in the upper 13 feet (4 meters) exceed the residential action levels for excavated soils. Therefore, soils requiring removal are assumed to extend 1-foot (.3 meter) below the deepest sample interval where the exceedence occurred.

Lateral Extent: A circle with a radius of 30 feet (9 meters) around Boring A9.

- Detections of Ni were noted at K&D26 (approximately 50 feet (15 meters) southwest of A9) from depth intervals of approximately 1-3 feet (.3 to 1 meter) and 7-10 feet (2.1 to 3 meters) at concentrations below the residential action levels. Therefore, removal of soils that extend to this location appears unnecessary. No additional samples in the vicinity of Boring A9 were analyzed for TPH.

- Review of historical information indicated that Boring A9 is located near the intersection of two former railroad tracks. Activities associated with the spur, such as maintenance and loading or unloading operations, may be a possible source of the Ni and TPH.

- Since any release associated with railroad activities would most likely be localized along the tracks, and Boring A9 was located near the intersection of two tracks, it is estimated that soil requiring removal would extend 30 feet (9 meters) from Boring A9 in all directions.

Disposal Method: Dispose as petroleum contaminated soils. Nickel concentrations are judged to be low enough as not to be of concern for disposal purposes.

RCRA · Disposal

AREA: N2

Constituents of Concern: Lead (Pb), Barium (Ba)

Action Level(s): Pb- 400 mg/kg (excavated soils), 5,000 mg/kg (remaining soils)
Ba- 266 mg/kg (excavated soils), 143,080 mg/kg (remaining soils)

Exceedence Location: SB131

Depth of Excavation: 0 to 4 feet (0-1.2 meters)

- One exceedence of the Pb residential action levels was noted at a depth interval of 1 to 5 feet (.3 to 1.5 meters) at boring SB131 (2,540 mg/kg). One exceedence of the Ba residential action level was also noted at the same depth interval at SB131 (328 mg/kg). No samples were analyzed for metals below 5 feet (1.5 meters) at this location. This sample was located along the eastern edge of Block N near a proposed roadway area.

- Construction of the roadway was assumed to require excavation and grading up to a depth of 4 feet (1.2 meters). Since the detected concentrations are below the commercial/industrial action levels for remaining soils, it is assumed that soils requiring removal will extend to a depth of 4 feet (1.2 meters), and soils below this depth can remain in place.

Lateral Extent: A rectangle 20 feet x 60 feet (6 meters x 18 meters) centered around Boring SB131.

- Detections of Pb and Ba were also noted at Boring K&D B14 at a depth interval of 3 to 3.5 feet (1 to 1.1 meter) at concentrations below the residential action levels. K&D B14 is located approximately 60 feet (18 meters) northwest of SB131. No other soil samples were analyzed for metals in the vicinity of SB131 that could be used to delineate the lateral extent.

- Review of historical information indicated that SB131 is located near a former railroad spur in an area previously used for the storage of scrap metal. In addition, metal cleaning and cooling activities, coal storage, and a former brass foundry were located in Building 158 to the east of SB131. Activities associated with the spur, such as loading or unloading operations, the scrap metal storage, and operations within Building 158 may be possible sources of the metals.

- A release, or other activities associated with railroad activities that may have contributed to the contamination, would most likely be localized along the track. Therefore, assuming that the tracks were 10 feet (3 meters) wide, it is estimated that soil requiring removal would extend 5 feet (1.5 meters) beyond each edge of the track in an east-west direction, and 30 feet (9 meters) either side of SB131 in a north-south direction.

Disposal Method: Dispose as commercial/industrial fill, or landfill.

AREA: N3

Constituents of Concern: Benzo(a)pyrene (B(a)P)

Action Level(s): 9,000 μg/kg (excavated soils)
78,000 μg/kg (remaining soils)

Exceedence Location: SB76

Depth of Excavation: 0 to 4 feet (0 to 1.2 meters)

- One exceedence of the B(a)P residential action level was noted at a depth interval of 2 to 4 feet (.6 to 1.2 meters) at boring SB76 (10,000 μg/kg). This concentration is below the commercial/industrial action level. This sample was located along the western edge of Block N within a proposed roadway area.

- Construction of the roadway was assumed to require excavation and grading up to a depth of 4 feet (1.2 meters). It is assumed that soils requiring removal will extend to a depth of 4 feet (1.2 meters), and soils below this depth can remain in place.

Lateral Extent: A rectangle 20 feet x 40 feet (6 meters x 12 meters) centered around Boring SB76.

- Review of historical information indicated that SB76 is located near the former brass foundry and a rail spur and these. may be possible sources of the B(a)P.

Disposal Method: (Dispose as commercial/industrial fill, or landfill.) - ??

BLOCK O

Block O contained nine chemicals at concentrations that exceeded the residential Tier I action levels:

.37 - RBC two orders of mag

- Arsenic: 250 mg/kg at A16 exceeding the action level of 40 mg/kg
- Cadmium: 6.4 mg/kg at A16 exceeding the action level of 6 mg/kg
- Lead: (three exceedences of the action level of 400 mg/kg)
  1,020 mg/kg at K&D32A
  540 mg/kg at A16
  2,610 mg/kg at SB-46

  RBC-23
- Mercury: 20.2 mg/kg at A16 exceeding the action level of 3 mg/kg
- Selenium: 7 mg/kg at A16 exceeding the action level of 3 mg/kg
- Benzo(a)pyrene: 27,000 μg/kg at K&D32A exceeding the action level of 9,000 μg/kg 88 ug RBC
- ? What is this? Phenanthrene: 140,000 μg/kg at K&D32A exceeding the action level of 64,900 μg/kg
- PCB (two exceedences of the action level of 1,000 μg/kg)
  210,000 μg/kg at K&D32A 83 RBC
  2,400 μg/kg at SB129
- TPH: (three exceedences of the action level of 10 mg/kg)
  1,700 mg/kg at SB10
  1,200 mg/kg at SB7
  46 mg/kg at SB14

These exceedences were evaluated against Tier II criteria. The frequency of exceedences is high. The magnitude of the exceedences is high, ranging from 1.1 to over 200 times the residential action levels. No monitoring well is located downgradient of these sample locations, so the impact on groundwater is unknown. Based on these factors, the action level exceedences are judged to be significant. It is recommended that the areas around sample locations K&D32, SB129, A16, SB7, SB10 and SB14 be excavated and handled separately from general fill soils. The areas to be removed are shown on Figure 7-14 (enlarged area from Plate 1).

AREA: O1

Constituents of Concern: PCBs, Lead (Pb), Benzo(a)pyrene, Phenanthrene

Action Level: PCBs- 1,000 μg/kg (excavated soils), 10,000 μg/kg (remaining soils)
Pb- 400 mg/kg (excavated soils), 5,000 mg/kg (remaining soils)
Benzo(a)pyrene - 9,000 μg/kg (excavated soils);
78,000 μg/kg (remaining soils for commercial/industrial land use);

16 MG. Removal
14.6Hcn

Phenanthrene - 67,600 μg/kg (excavated soils);
81,760,000 μg/kg (remaining soils for commercial/industrial land use).

Exceedence Locations: K&D32, SB129, A16, SB7, SB10 and SB14

Depth of Excavation: 0 to 5 feet (0 to 1.5 meters)

- One exceedence of each of the PCB, Pb, benzo(a)pyrene, and phenanthrene residential action levels for excavated soils was noted at a depth interval of 0.5 to 2.5 feet (.2 to .76 meters) at K&D32. Concentrations of PCBs, Pb, benzo(a)pyrene, and phenanthrene at this depth interval were 210,000 μg/kg, 1,020 mg/kg, 27,000 μg/kg, and 140,000 μg/kg, respectively. Concentrations of Pb, benzo(a)pyrene, and phenanthrene were below the commercial/industrial action levels, while the concentration of PCB at this location exceeded the commercial/industrial action level. Results at K&D32 from a depth interval of 10 to 12 feet (3 to 4 meters) were below residential action levels for each of these constituents. No action level exceedences below 2.5 feet (.76 meters) were noted from soil samples in surrounding borings, suggesting that the highest concentrations are localized around Boring K&D32. The samples are located in the southern portion of Block O.

- Excavation of Block O will most likely extend to depths of 20 to 30 feet (6 to 9 meters). Since PCBs, PAHs and metals are relatively immobile in soil, and considering the relatively high concentration of PCBs at 2.5 feet (.76 meters), soils requiring removal are assumed to extend 2.5-feet (.76 meters) below the sample interval where the exceedence occurred.

Lateral Extent : A circle with a radius of 20 feet (6 meters)around K&D32.

- Reportedly, areas within Block O were used for temporary storage of drained transformers. Block O was also the location of a former steel foundry. Although the actual location of these activities is uncertain, this may be a possible source of the PCBs, Pb, and PAHs. Any PCB releases may be at isolated or localized areas on the block where transformers were not completely drained. K&D32 is believed to be one of these areas.

- In addition to K&D32, PCBs and Pb were also detected at Borings SB88, SB89, and SB90 at concentrations below the residential action levels for excavated soils. Results from these borings, located around K&D32 at a distance of approximately 20 feet (6 meters), indicate that removal of soils beyond these locations is unnecessary. Field-screening for PAHs was also conducted at these three locations and one sample from boring SB90 (0.5 to 4.5 feet (.1 to 1.4 meters)) was sent for laboratory confirmation. Benzo(a)pyrene and phenanthrene results from this sample were below the residential action levels for excavated soils. Based on these factors, it is assumed that soils requiring removal extend 20 feet (6 meters) from K&D32 in all directions.

- what are these levels?

Disposal Method: Disposal at a TSCA approved facility (soil concentration greater than 500 mg/kg).

<u>AREA: O2</u>

Constituents of Concern: PCBs

Action Level: 1,000 μg/kg (excavated soils)
10,000 μg/kg (remaining soils)

Exceedence Location: SB129 (2,400 μg/kg)

Depth of Excavation: 0 to 5 feet (0 to 1.5 meters)

- One exceedence of the PCB residential action level was noted at a depth interval of 0 to 4 feet (0 to 1.2) at SB129. This sample was located near the northeast corner of Block O and was at the edge of a proposed roadway area. No samples were analyzed below 4 feet (1.2 meters) at this location.

- Construction of the roadway was assumed to require excavation and grading up to a depth of 4 feet (1.2 meters), and excavation of Block O will most likely extend to a depth of 30 feet (9 meters). Since PCBs are relatively immobile in soil, soils requiring removal are assumed to extend 1-foot (.3 meter) below the sample interval where the exceedence occurred.

Lateral Extent: A circle with a radius of 30 feet (9 meters) around SB129.

- Reportedly, areas within Block O were used for temporary storage of drained transformers. Although the actual location of storage areas and draining operations are uncertain, this may be a possible source of the PCBs. Any releases may be at isolated or localized areas on the block where transformers were not completely drained. SB129 is believed to be one of these areas.

- No other soil samples were analyzed for PCBs in the vicinity of SB129. Since SB129 is the only data point for PCBs, and the exact location of the source within Block O is uncertain, it is assumed that soil requiring removal extends 30 feet (9 meters) from SB129 in all directions.

Disposal Method: Dispose as commercial/industrial fill, or landfill.

AREA: O3

Constituents of Concern: TPH, Arsenic (As), Cadmium (Cd), Lead (Pb), Mercury (Hg), Selenium (Se)

Action Level:
TPH- 10 mg/kg (excavated soils), 100 mg/kg (remaining soils)
As- 40 mg/kg (excavated soils), 382 mg/kg (remaining soils)
Cd- 6 mg/kg (excavated soils), 1,022 mg/kg (remaining soils)
Pb- 400 mg/kg (excavated soils), 5,000 mg/kg (remaining soils)
Hg- 3 mg/kg (excavated soils), 613 mg/kg (remaining soils)
Se- 3 mg/kg (excavated soils), 10,220 mg/kg (remaining soils)

Exceedence Location: A16

Depth of Excavation: 0 to 5 feet (0 to 1.5 meters)

- One exceedence of each of the TPH, As, Cd, Pb, Hg, and Se residential action levels was noted at an undetermined depth interval at Boring A16. Concentrations of TPH, As, Cd, Hg, and Se at this location were 1,140 mg/kg, 250 mg/kg, 6.4 mg/kg, 540 mg/kg, 20.2 mg/kg, and 7 mg/kg, respectively. Concentrations of As, Cd, Pb, Hg, and Se were below commercial/industrial action levels; the TPH concentration exceeded the DCERA's in-place action level. Though the depth interval for this sample was not specified in the Apex report, this sample is believed to be from shallow soils. This is supported by an APEX reference to this sample as a "surface sample" at one location in the report, and that this sample was collected from the floor of a former coal ash pit. No samples were collected below this "surface sample" at this location. Samples from surrounding Borings SB81, SB82, and SB83 were analyzed for Pb at a depth interval of 0 to 4 feet (0 to 1.2 meters). No action level exceedences were noted at these locations. These samples are located in a proposed roadway area to the east of Block O.

- Construction of the roadway was assumed to require excavation and grading up to a depth of 4 feet (1.2 meters), and excavation of Block O will most likely extend to a depth of 30 feet (9 meters). Since surrounding Pb concentrations at a depth interval of 0 to 4 feet (0 to 1.2 meters) were below the residential action level, and assuming that the sample from A16 was collected from a depth of 0 to 4 feet (0 to 1.2 meters), soils requiring removal are assumed to extend to a depth of 5 feet (1.5 meters).

Lateral Extent: A circle with a radius of 15 feet (4.5 meters)

- Reportedly, Boring A16 was collected from a former coal ash pit where coal residues, and other materials from the power plant were slurried and allowed to settle. Boring A16 is also located near a former railroad spur. This coal ash pit, and activities associated with the railroad, may be a possible source of the TPH and metals.

- As stated earlier, results from three borings surrounding A16 were below the Pb residential action level indicating that removal of soils beyond these borings is unnecessary. These borings were located 20 feet (6 meters) north, 15 feet (4.6 meters) east, and 20 feet (6 meter) west of Boring A16. No other soil samples were analyzed for TPH, As, Cd, Hg, or Se in the vicinity of A16. Boring K&D38, located approximately 80 feet (24 meters) south of A16, had detections of As, Cd, Hg, and Se below the residential action levels for excavated soils. Since A16 is the only data point for TPH, As, Cd, Hg, and Se, it is assumed that soil requiring removal extends to the surrounding borings where Pb concentrations were below the residential action level for excavated soils. This equates to a circle with a 15-foot (4.6 meter) radius that includes A16.

Disposal Method: Dispose as industrial/commercial fill, or landfill.

AREA: O4

Constituents of Concern: TPH, Lead (Pb)

Action Level: TPH- 10 mg/kg (excavated soils), 100 mg/kg (remaining soils)
Pb- 400 mg/kg (excavated soils), 5,000 mg/kg (remaining soils)

Exceedence Locations: SB7, SB10, SB14, SB46

Depth of Excavation: 0 to 16 feet (0 to 4.9 meters)

- Three exceedences of the TPH action level for excavated soils were noted at Borings SB7 (1,200 mg/kg), SB10 (1,700 mg/kg), and SB14 (46 mg/kg) at a depth interval of 13 to 15 feet (4 to 4.6 meters). One exceedence of the Pb residential action level was noted at a depth interval of 12 to 14 feet (3.7 to 4.3 meters) at SB4. In addition, field-screening results conducted at SB7, SB10, and SB14 indicate that TPH concentrations above the action level for excavated soils may be present at deeper (down to the water table) and shallower depths. These samples are located near the northeast corner of Block O, both within the block and in a proposed roadway area north of the block.

- Construction of the roadway was assumed to require excavation and grading up to a depth of 4 feet (1.2 meters), and excavation of Block O will most likely extend to a depth of 30 feet (9 meters). TPH concentrations of borings within the proposed roadway also exceed the action level for remaining soils. Therefore, soils requiring removal are assumed to extend 1-foot (.3 meters) below the sample interval where the exceedence occurred.

Lateral Extent: A rectangle 80 feet x 160 feet (24 meters x 49 meters) around Borings SB7, SB10, SB14, and SB46 (less the volume removed from Area O2).

- No other soil samples were analyzed for TPH to the east, south, and west of these exceedences. Block H, where many scattered exceedences of TPH were noted, is located immediately to the north of Block O and may be a possible source for TPH contamination within and to the north of Block O.

- Since TPH exceedences within the roadway area were well above the action level for remaining soils, and there are limited data to help define the lateral extent of contamination, it is assumed that soil requiring removal is within an 80-foot x 160-foot (24 meters x 49 meters) rectangle that extends to Block H to the north, and the edge of Block O to the east. It should be noted that soils requiring removal in Area O2 overlaps this rectangle. Therefore, the volume of soil from Area O2 that extends into Area O4 is subtracted from the entire volume of Area O4 for the volume calculations.

Disposal Method: Dispose as TPH contaminated soil. Lead is not considered significant.

AREA SOUTH OF BLOCKS M, N, AND O

The area of land south of blocks M, N, and O (termed the south fill, or SF, area) is considered as one functional area because of the similarity of chemicals detected in samples and the common construction activities to be conducted in the future. Six chemicals were detected at concentrations that exceeded the Tier I residential action levels.

- Copper: 8,460 mg/kg at K&D33A exceeding the action level of 5,475 mg/kg

- Lead: (8 exceedences of the action level of 400 mg/kg)
  628 mg/kg at A-17
  1,100 mg/kg at K&D33A
  533 mg/kg at K&D39B
  480 mg/kg at SB96
  2,630 mg/kg at SB97
  630 mg/kg at SB99
  1,970 mg/kg at SB100
  542 mg/kg at SB130

- Mercury: 3.7 mg/kg at K&D23A exceeding the action level of 3 mg/kg

- Nickel (2 exceedences of the action level of 100 mg/kg)
  142 mg/kg at A14d
  464 mg/kg at K&D27A

- Bis(2-chloroisopropyl)ether: 270 μg/kg at K&D39B exceeding the action level of 39 μg/kg

- TPH: 124 mg/kg exceeding the action level for excavated soils of 10 mg/kg and the action level for in-place soils of 100 mg/kg

These exceedences were evaluated against Tier II criteria. The frequency of exceedences is high. The magnitude of the exceedences is high, ranging from 1.2 to over 12 times the residential action levels. Based on these factors, the action level exceedences are judged to be significant. It is recommended that the impacted areas in this area be excavated and handled separately from general fill soils. The areas to be removed are shown on Figure 7-xx (enlarged area from Plate 1).

AREA: SF1

Constituents of Concern: Copper (Cu), lead (Pb)

Action Level: Cu- 5,475 mg/kg (excavated soils), 143,080 mg/kg (remaining soils)
Pb- 400 mg/kg (excavated soils), 5,000 mg/kg (remaining soils)

Exceedence Locations: K&D33A, SB96, SB97, SB99, SB100, SB130

Depth of Excavation: 0 to 10 feet (0 to 3 meters)

- One exceedence of the residential action levels for Cu and Pb were noted at a depth interval of 2 to 4 feet (.6 to 1.2 meters) at K&D33A (8,460 mg/kg and 1,100 mg/kg, respectively), but these concentrations do not exceed commercial/industrial action levels. Exceedences of the residential action level for lead were also noted at SB96 (480 mg/kg), SB97 (2,630 mg/kg), SB99 (630 mg/kg), SB100 (1,970 mg/kg), and SB130 (542 mg/kg). None of these concentrations exceed the commercial/industrial action level.

- Because these soils contain chemicals in excess of residential action levels but not in excess of the commercial/industrial action levels, these soils should be excavated and handled separately from general fill soils. The areas to be removed are shown on Figure 7-15 (enlarged area from Plate 1).

Lateral Extent : Rectangular area approximately 250 x 75 feet (76 x 23 meters) parallel to the seawall

Disposal Method: Dispose as industrial/commercial fill, or landfill.

AREA: SF2

Constituents of Concern: Mercury (Hg), Nickel (Ni), Lead (Pb), bis(2-chloroisopropyl)ether (BCIE)

Action Level: Hg - 3 mg/kg (excavated soils), 613 mg/kg (remaining soils)
Ni- 100 mg/kg (excavated soils), 40,880 mg/kg (remaining soils)
Pb- 400 mg/kg (excavated soils), 5,000 mg/kg (remaining soils)
BCIE- 39 μg/kg (excavated soils), 704,000 μg/kg (remaining soils)

Exceedence Locations: A14d, K&D23A, K&D27A, K&D39B

Depth of Excavation: None required

- One exceedence of the residential action level for mercury was noted at K&D23A (3.7 mg/kg)at a depth interval of 1 to 3 ft (.3 to 1 meter). Two exceedences of the residential action level for nickel were noted at A-14d (142 mg/kg at 8 to 12.5 feet (2.4 to 4.0 meters)) and K&D27A (464 mg/kg at 1 to 3 feet (.3 to 1 meter)). One exceedence of the residential action level for BCIE and Pb were noted at K&D39B at a depth interval of 7 to 9 feet (2.1 to 2.7 meters) (270 μg/kg and 533 mg/kg, respectively). None of the detected concentrations of these chemicals exceed the commercial/industrial action levels.

- These sample locations are located further than 35-40 feet (11-12 meters) from the river front. Excavation in this area may occur only for grading purposes, followed by cover and vegetation.

- Because the chemical concentrations detected in these areas exceed residential action levels, any soils removed from these areas should be excavated and handled separately from general fill soils. Since the concentrations are below commercial/industrial action levels, soils that are not removed as part of grading or construction purposes can remain in place.

AREA: SF3

Constituents of Concern: Lead (Pb), TPH

Action Level: Pb- 400 mg/kg (excavated soils), 5,000 mg/kg (remaining soils)
TPH- 10 mg/kg (excavated soils), 100 mg/kg (remaining soils)

Exceedence Locations: A17, A19

Depth of Excavation: None

Sample A17 contained lead at a concentration of 628 mg/kg which exceeded the residential action level of 400 mg/kg but not the commercial/industrial action level of 5,000 mg/kg. Location A-19 contained TPH at a concentration of 124 mg/kg in excess of both the excavation action level (10 mg/kg) and in-place action level (100 mg/kg). These sample locations appear to be located in the Anacostia River, where neither excavation nor exposure will occur. No action is required in response to these detections.

7.3 EVALUATION OF GROUNDWATER

Groundwater was sampled and analyzed for volatile, semi-volatile and inorganic constituents (metals). Samples were collected from both monitoring wells and from use of a Hydropunch™. Samples obtained by Hydropunch™ are screening level data that are best used as a measure of chemical absence or presence only. Because Hydropunch™ groundwater samples may contain suspended soil particles, they are not reflective of true groundwater quality. This is particularly true for chemicals that display a strong soil-binding tendency, such as metals and PAHs. Monitoring well and Hydropunch™ groundwater sampling results are presented in Appendix C.

7.3.1 Monitoring Well Data

Table 7-6 summarizes the chemicals detected in groundwater and compares the maximum detected concentration to the groundwater action level. Thirty six chemicals or parameters were detected in groundwater samples from across the site. These were:

Volatile Organic Compounds

Acetone
Benzene
Carbon disulfide
Chloroform
Ethylbenzene
4-Methyl-2-pentanone
Toluene
1,1,2-Trichloroethane
Xylenes

Semi-volatile Organic Compounds

Acenaphthene
Bis(2-ethylhexyl)phthalate
Butylbenzylphthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
2-Methylnaphthalene
Naphthalene
n-Nitrosodiphenylamine

Inorganic Constituents

Aluminum
Arsenic
Barium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Magnesium
Manganese
Mercury
Nickel
Potassium
Sodium
Vanadium
Zinc
TPH

Of these, seven were present at concentrations exceeding action levels. These were:

- Benzene (exceeding the action level of 5 μg/L):
  - 2,000 μg/L at MW-03 (K&D data)
  - 79 μg/L at MW-03 (W-C data)
  - 80 μg/L at MW-13

  RBC. = .36
- 1,1,2-Trichloroethane: 17 μg/L at MW-03 exceeding the action level of 5 μg/L
- Iron (exceeding the action level of 18,250 μg/L):
  - 91,500 μg/L at MW-03
  - 33,900 μg/L at MW-04
  - 24,300 μg/L at MW-06
- Manganese: 7,090 μg/L at MW-03, exceeding the action level of 5,110 μg/L
- Nickel (exceeding the action level of 100 μg/L)
  - 102 μg/L at MW-21
  - 213 μg/L at MW-15
- Sodium (exceeding action level of 5,110 μg/L)
  - All detections, ranging from 5,480 μg/L to 311,000 μg/L
- TPH (exceeding the action level of 1,000 μg/L)
  - 1,100 to 1,200 μg/L at MW-10
  - 1,600 μg/L at MW-13

Excluding sodium, wells MW-03, MW-04, MW-06, MW-10, MW-13, MW-15, MW-21 contain chemicals in excess of the action level. The presence of sodium in all wells may be a result of de-icing operations historically conducted on site.

Chemical exceedences by well is as follows:

MW-03 (Block B):	Benzene; 1,1,2-Trichloroethane; Iron
MW-04 (S. of Block M):	Iron
MW-06 (S. of Block N):	Iron
MW-10 (S. of Block B):	TPH
MW-13 (S. of Block B):	Benzene; TPH
MW-15 (E. of Block O):	Nickel
MW-21 (E. of Block M):	Nickel

Benzene and TPH, both petroleum-related chemicals, were detected in groundwater at MW-03 and MW-13; TPH was also detected in MW-10 (MW-10 and MW-13 are adjacent to one another). All three wells are located downgradient from an off-site gasoline service station located north of the site that has had a recognized release of fuel. These exceedences are the only detections of benzene and TPH in site groundwater collected from monitoring wells. Ethylbenzene, toluene and xylenes, all petroleum-related chemicals, were also detected in MW-03 and MW-13, but at concentrations below their respective action levels. 1,1,2-Trichloroethane in MW-03 was detected once in groundwater during sampling conducted by K&D, but was not detected when this well was resampled in 1995 by W-C. 1,1,2-Trichloroethane was not detected in site soils. The source of this chemical is not known, but laboratory error is a possibility.

MW-04, MW-06, MW-15, and MW-21 contain elevated levels of metals. MW-04 (iron), MW-06 (iron) and MW-15 (nickel) are located in the made land portions of the site to the south and east and the presence of metals in groundwater may reflect the prevalence of metals in the material used to create the made land. MW-21 (nickel) is located adjacent to the northeastern edge of Block M.

7.3.2 Hydropunch Data

Hydropunch data were collected from various locations around the site, generally from two depth intervals: a shallow subsurface zone (roughly 10 to 30 feet (3 to 9 meters) BGS)) and a deeper subsurface zone (roughly 70 to 80 feet (21 to 24 meters BGS)).

7.3.2.1 Volatile Organic Compounds

Evaluation of VOCs in Hydropunch™ groundwater samples is the most meaningful use of the Hydropunch™ data since VOCs, as a class, have a low soil sorption tendency. This low soil sorption tendency suggests that soil particles entrained in the sample will have less of an impact on analytical results.

The following VOCs were detected in Hydropunch™ samples:

Acetone	Benzene
2-Butanone	Carbon disulfide
Chlorobenzene	Chloroform
1,1-Dichloroethene	Ethylbenzene
Toluene	1,1,1-Trichloroethane
Trichloroethene	Xylenes

The presence of benzene, ethylbenzene, toluene, and xylenes, all petroleum-related chemicals, is centered in Block B, downgradient from the known off-site source in samples HP1, HP3, HP4, HP5, HP6, HP7, HP14 and in the upper zone in HP36..

Acetone and 2-butanone were detected in Hydropunch™ samples but were not detected in monitoring well samples. Both chemicals were reported in soil samples, but below concentrations that could impact groundwater quality. Both acetone and 2-butanone are common sampling and laboratory artifacts.

Carbon disulfide was detected in both Hydropunch™ samples (Block N) and monitoring well samples (Block O) at low concentrations. The Hydropunch™ sample concentration is below the action level applicable to groundwater.

Chloroform was detected in four Hydropunch™ samples (Blocks N and O) and also at low concentrations in monitoring well samples (Blocks B, H, M, and O). The Hydropunch™ sample concentrations were all less than the action level for groundwater.

Chlorobenzene was detected in one Hydropunch™ sample in Block C (HP-10 at 23 feet below ground surface (BGS)), but was not detected in monitoring well samples from any location on site nor was it detected in any soil sample.

1,1-Dichloroethene was detected in one Hydropunch™ sample in Block C (HP-4) at a depth of 71 feet (22 meters) BGS. 1,1-Dichloroethene was not detected in any monitoring well sample, nor was it detected in any soil sample. The concentration detected (2,004 μg/L) exceeded the action level for groundwater (MCL of 7 μg/L).

.0AA ug/L ABC

1,1,1-Trichloroethane was detected in three Hydropunch™ samples in Block B (HP-7 at 21 feet BGS, HP-7 at 65 feet (20 meters) BGS, and HP-13 at 71 feet BGS). 1,1,1-Trichloroethane was not detected in any monitoring well sample, and was only once in soil samples (K&D B3 south of Block B) at a concentration (8 μg/kg) below that which could impact groundwater (900 μg/kg). The concentrations detected in Hydropunch™ samples were below action level for groundwater (MCL or 200 μg/L).

Trichloroethene (TCE) was detected in three Hydropunch™ samples at Block B (HP-14 at 70 feet BGS), Block C (HP-04 at 71 feet (22 meters BGS) and Block H (HP-32 at 11 feet (3.4 meters BGS)). Hydropunch™ sample concentrations detected at HP-14 and HP-04 exceeded the action level for groundwater (5 μg/L). TCE was not detected in any monitoring well sample.. TCE was detected in site soils in five samples, one of which exceeded the soil action level for protection of groundwater quality (discussed in Section 6.0). However, soil and groundwater TCE detections do not appear spatially related.

7.3.2.2 Semi-volatile Organic Compounds

Numerous SVOCs were detected in Hydropunch™ samples, including PAHs (numerous detections), phenolic compounds (one detection each of 4-methylphenol and 2,4-dimethylphenol at concentrations estimated below the quantitation limit), phthalates (several detections), and carbazole (two detections at concentrations estimated below the quantitation limit). All of these chemicals were detected at some location in site soils. Given that these chemicals display moderate to strong soil binding properties and Hydropunch™ samples may have entrained soil particles in them, the presence of these chemicals may not be representative of groundwater quality.

7.3.2.3 Metals

All metals analyzed were detected in Hydropunch™ samples. Since metals are natural constituents in soil and may also be present in the made land and from previous site activities, presence of metals in Hydropunch™ samples is not unexpected. Given that metals generally display strong soil binding properties and Hydropunch™ samples may have entrained soil particles in them, the presence of these chemicals may not be representative of groundwater quality.

7.4 SUMMARY AND DISCUSSION

Soils and groundwater from the SEFC were evaluated by comparing the chemical concentrations detected in three sampling events with regulatory or health-based action levels. Soils to be excavated as a part of site construction activities were evaluated against conservative action levels protective of residential exposures to determine whether the soils were appropriate for use as general fill material with no use restrictions. Soils that will remain on site after the completion of construction activities were evaluated against conservative action levels protective of commercial/industrial or recreational exposures to determine whether the soils required additional management or treatment. Groundwater was evaluated against regulatory or health-based action levels protective of drinking water resources.

The majority of the soils that will be excavated were acceptable for use as general fill with no use limitations. All soils from Blocks B, C, D and E were judged to be acceptable for use as general fill. Soils in Blocks A, F, G, J, K, L, M, N and O and the area south of Blocks M, N and O were generally acceptable for use as general fill, except for isolated areas that warrant appropriate management. All soils from Block H were judged not to be appropriate for use as general fill material. Block H had numerous exceedences of action levels for several chemicals. With a few exceptions, soils that will remain in place after completion of construction activities are generally acceptable for remaining in place with no additional treatment. With the exception of K&D21, these areas were identified as requiring further attention because of the presence of TPH in excess of the DCERA soil cleanup standards.

During construction, appropriate screening, verification testing and characterization testing of the soils will be required as excavation proceeds. In some cases, quantities may decrease, but new areas of contamination may also be found. A flexible approach during construction is recommended to deal with the actual contamination encountered.

? Overall, groundwater has been minimally impacted at the Southeast Federal Center. Monitoring well and Hydropunch™ data identified fuel-related components in groundwater at Block B and portions of Blocks C and F, downgradient from a known off-site source. It is expected that this contamination plume will be remediated at the expense of the responsible party with proper coordination with DCERA. Nickel and iron were identified in some monitoring well samples at concentrations above the action levels, but these metals may derived from the made land or other fill material on site. Sodium was also detected in monitoring well samples at concentrations above its action level, but may be from de-icing operations on the site. Hydropunch™ samples identified additional organic compounds, but often these compounds were not detected, or minimally detected, in monitoring well or soil samples. The source or sources of these compounds is not clear.

8.0
VOLUME CALCULATIONS

A risk-based analysis of existing analytical sample data was used to develop the likely extent of contamination at the various areas identified with contamination. The dimensions for the excavation calculations are taken from the text in Chapter 7 that describes each of the blocks and the extent of contamination. Regular geometric shapes (rectangles, squares, and circles) were used for excavation calculations. The depths of excavation are assumed to be perpendicular to the surface (i.e., not sloped) since these areas will be encountered during the excavation of a much larger area. When contaminated soils are encountered, the contaminated soil will be handled separately from the surrounding excavation. Also, surface materials (i.e., pavement) were ignored for the calculations. The volume calculations are summarized in Table 8-1.

The typical surface shapes for calculations were rectangles and circles. The area of the surface shapes was determined and then multiplied by the depth of contamination to obtain the excavation volume. An average soil density of 120 pounds per cubic foot (1.92 Mg/m^3) was assumed. The average density is a conservative estimation of density for moist granular soils. The volume of excavated soil is multiplied by the density to obtain the weight (mass) of the excavated material. The weight (mass) is expressed in units of tons. A short ton (standard unit) equals 2000 pounds and a metric ton (metric units) equals 1000 kg or 1 Mg. The unit of ton is used because unit prices for disposal of excavation materials are typically based on a cost per ton basis.

Assumptions made for the volume calculations are presented below.

- Typical volume calculations for excavation of soil:

  Rectangular shape: length (ft) * width (ft) * depth(ft) * 1 yd^3 / 27 ft^3 = yd^3
  length (m) * width (m) * depth (m) = m^3

  Circular shape: π * (radius (ft))^2 * depth (ft) * 1 yd^3 / 27 ft^3 = yd^3
  π * (radius (m))^2 * depth (m) = m^3

- To convert (standard units) from volume (cubic yards) of soil to weight (tons) of soil:

  Assume average total density of soil = 120 lb/ft^3
  120 lb/ft^3 * 27 ft3/yd^3 * 1 ton / 2,000 lb = 1.62 ton/yd^3
  Volume (cubic yards) * 1.62 = Weight (tons)

- To convert (metric units) from volume (cubic meters) of soil to mass (Megagrams) of soil:

  Assume average total density of soil = 1.92 Mg/m^3
  Volume (cubic meters) * 1.92 Mg/m^3 = Mass (Mg)
  One Mg = one metric ton

Area G2 and Area O4 had irregular shapes due to overlapping areas of different contamination. The irregular shaped volumes were calculated based on the following assumptions:

- Assumptions for Area G2

  Irregular shape defined by the circle G2 minus the section of G1 that overlaps the circle G2.
  Circular shape G2: depth = 18 feet (5.5 m), radius = 30 feet (9.2 m)
  Overlap section is two equal circular segments with a chord length = 48.2 feet (14.7 m), a rise = 13.0 feet (4.0 m), and a depth = 4 feet (1.2 m).
  Overlapping Area = (2 * chord length * rise/3)* 2 = 835.5 ft^2 (77.6 m^2)
  Overlapping Volume (cubic yards) = Area (ft^2) * depth (ft) / 27 ft^3/yd^3 = 123.8 yd^3
  Overlapping Volume (cubic meters) = Area (m^2) * depth (m) = 93.1 m^3

- Assumptions for Area O4

  Area O4 is an irregular shape defined by the rectangle O4 minus the circular section of O2 that overlaps O4.

Rectangular shape O4: depth = 16 feet (4.88 m), length = 160 feet (48.8 m), and width = 80 feet (24.4 m).

The overlapping section is a circular segment with a chord length = 55 feet (16.8), a rise = 18.8 feet (5.7 m), and a depth = 5 feet (1.7 m).

Overlapping Area = 2 * chord length * rise/3 = 689.3 ft^2 (64.0 m^2)

Overlapping Volume (cubic yards) = Area (ft^2) * depth (ft) / 27 ft^3/yd^3 = 128 yd^3

Overlapping Volume (cubic meters) = Area (m^2) * depth (m) = 108.9 m^3

9.0 REFERENCES

APEX Environmental, Inc. (1990). Phase 1 Environmental Study, Southeast Federal Center, Washington, D.C.

ATSDR (1990). Toxicological Profile for Polycyclic Aromatic Hydrocarbons. TP-90-20.

District of Columbia, Department of Consumer and Regulatory Affairs, Environmental Regulation Administration (1994). Letter from Gregory Hope, Underground Storage Tank Branch to John Dickson, Washington Metropolitan Area Transit Authority, September 1994.

District of Columbia Municipal Regulations, Title 20, Section 6212, Standards for Soil Quality.

Gilbert, R.O. (1987). Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold, Publishers, New York.

Kaselaan & D'Angelo Associates, Inc. (1991). Phase II Subsurface Investigation at Southeast Federal Center

U.S. EPA (1994a). Soil Screening Guidance. EPA/540/R-94/101.

U.S. EPA (1994b). Technical Background Document for Soil Screening Guidance. EPA/540/R-94/102.

U.S. EPA (1991a). Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions. OSWER Directive 9355.0-30, April 22.

U.S. EPA (1991b). Human Health Evaluation Manual, Supplemental Guidance, 'Standard Default Exposure Factors'. OSWER Directive 9285.6-03. March.

U.S. EPA (1990). Guidance on Remedial Actions for Superfund Sites with PCB Contamination. EPA/540G-90/007, August.

U.S. Geological Survey (USGS) (1984). Element Concentration in Soils and Other Surficial Materials of the Conterminous United States. USGS Professional Paper 1270.